Evaluation of a school-based menstrual hygiene educational intervention among adolescent girls in Bangladesh

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2013-004607
Article Type:	Research
Date Submitted by the Author:	03-Dec-2013
Complete List of Authors:	Haque, Syed Rahman, Mosiur Itsuko, Kawashima Mutahara, Mahmuda Kayako, Sakisaka
Primary Subject Heading:	Public health
Secondary Subject Heading:	Global health
Keywords:	Epidemiology < TROPICAL MEDICINE, EPIDEMIOLOGY, Reproductive medicine < GYNAECOLOGY

Evaluation of a school-based menstrual hygiene educational intervention among adolescent girls in Bangladesh

Emdadul H. Syed,[1, 6*] Mosiur Rahman,[2] Kawashima Itsuko,[3] Mahmuda Mutahara, [4] Sakisaka Kayako,[5]

[1]UChicago Research Bangladesh, Dhaka, Bangladesh

[2]International Health Section, Division of Public Health, Graduate School of Tokyo Medical and Dental University, Tokyo, Japan

[3]Honjo International Scholarship Foundation, 1-14-9 Tomigaya, Tokyo 151-0063, Japan

[4]Wageningen University, Netherlands

[5]Faculty of Policy Studies, Chuo University, Japan

[6]United Nations University-International Institute for Global Health (UNU-IIGH), Malaysia

***Correspondence author:**
Dr Syed Emdadul Haque
UChicago Research Bangladesh
House #4, Road #2/B, Sector #4, Uttra-1230
Dhaka, Bangladesh
Email address: emdad91@gmail.com; emadad@urb-bd.org; syed.emdadul@unu.edu

ABSTRACT

Background: Poor menstrual hygiene practices are major determinants of morbidity and other complications among teenage girls, such as urinary tract infections, scabies in the vaginal area, abnormal abdominal pain, and absence from schools.

Objectives: To evaluate the effectiveness of a school-based menstrual education program regarding (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) restrictions and behaviors practiced by female students grades 6-8 in Bangladesh.

Methods: An intervention study was conducted in Araihazar, Bangladesh during April 2012 to April 2013. We recruited 416 adolescent female students (grades 6-8) from three rural schools. We delivered six months of educational intervention by trained (TOT by certified OB/GYN) Research Assistants on menstrual hygiene among school girls. The changes in knowledge, beliefs, and practices toward menstrual hygiene were compared between the baseline and the follow-up.

Results: After implementing the program, there was a significant increase in necessary knowledge among adolescents, from 51% to 82.4%. There was also highly significant improvement in good menstrual practices (28.8% to 88.9%). During our follow-up, we observed a significant reduction regarding experiences of excessive bleeding and greasy skin disorders. Also in the follow-up period, significant improvements were observed with regard to the

restrictions on visits to relatives, friends, and neighbors, and attending school during menstruation.

Conclusions: The program produced significant changes in the knowledge, beliefs, practices, and behavior or restrictions regarding menstrual hygiene. These results document the feasibility of implementing a health education program for adolescents on menstrual hygiene in secondary schools serving rural Bangladesh.

Keywords: School-based health education; Menstrual hygiene; Adolescent girls; Bangladesh

Strengths and limitations of this study

- This is the first evaluation study of menstrual educational program among adolescent school girls in Bangladesh.
- This study evaluated menstrual knowledge, beliefs, and practices of the students of grade 6-8 in Bangladesh. We also evaluated menstrual disorders experienced by the adolescents.
- The educational program showed significant increases on knowledge (51% to 82.4%), belief, and practices (28.8% to 88.9%).
- Significant improvements were also observed with regards to the restrictions on visits to relatives, friends, and attending school during the menstruation.
- The same educational program should implement for all adolescent girls in Bangladesh.

INTRODUCTION

Adolescence is a period of rapid transition in life from girlhood to womanhood. The onset of menstruation is one of the most important changes that occur for girls during the adolescent years.[1] The first menstruation (menarche) occurs between the ages of 11 and 15. [2-3] Poor menstrual hygiene and inadequate self-care are major determinants of morbidity and other complications among this age group such as urinary tract infections, scabies in the vaginal area, abnormal abdominal pain, complications during pregnancy, and absence from schools. [4-7] On the other hand, many parts of developing countries a culture of silence surrounds the topic of menstruation and related issues. [8-9] As a result, many young girls lack appropriate and sufficient information regarding menstrual hygiene. Infections due to lack of hygiene during menstruation have been reported in many studies. [10-15] They also revealed that most adolescent girls had incomplete and inaccurate information about menstrual physiology and hygiene. The menstrual information they did have was acquired primarily through mothers, television, friends, teachers, and relatives. [5, 16-17]

Menstruation is still regarded as something unclean or dirty in Bangladeshi society. [4] Because of various myths, misconceptions, and restrictions practiced during menstruation, adolescent girls in Bangladesh often develop negative attitudes towards this natural physiological phenomenon. The majority of girls lack scientific knowledge about menstruation and puberty. [18] Adolescent girls in Bangladesh are often reluctant to discuss this topic with their parents and hesitant to seek help regarding their menstrual problems. Most girls are not informed about menarche or how to manage menstrual bleeding. [18] Studies in rural Bangladesh and India found that 69.0% of adolescent girls were using old pieces of cloth or even no protection at all during menstruation. [19-20] Therefore, the need to create awareness and increase access to the requisite

sanitary infrastructure related to menstrual hygiene is important for school-aged adolescents in Bangladesh.

Learning menstrual hygiene is a vital part of health education for adolescent' girls so they can carry on regular work/habits throughout their adult life. [21] The ideal menstrual health education curriculum would encourage students to think about the relationships between knowledge, choice, behavior, and enhanced human health. However, despite the apparent need to achieve several millennium development goals (MDGs), to our knowledge no study has been conducted on menstrual hygiene educational intervention among school girls in Bangladesh. Therefore, the present study was designed to evaluate the effectiveness of a school-based menstrual educational program regarding, (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) the restrictions and behaviors practices by 6-8 grade school girls in Bangladesh.

METHODS

Study design and participants

This intervention study was conducted in Araihazar Thana, located at the Narayanganj District in Bangladesh. Araihazar Thana is located 25 km south-east of the capital, Dhaka. The total area of this Thana is 183.35 km² with 63,080 household units and a population of 331,556. Males constitute 51.7% of the population, and females 48.3%. Araihazar has an average literacy rate of 53.0% (7+ years of formal education), compared to the national average of 68.4%. [22]

Out of 26 high schools (grades 6-10) in the study area, we randomly selected three schools for this study. From these three schools, one was girls-only and the other two were

coeducational. The socioeconomics, cultural norms, religions, and geographical locations of these schools were very similar to each other but not adjacent. The analysis is based on 416 school-aged adolescent girls (Figure 1). Participants were selected using the following criteria: (1) they were within grades 6-8, (2) not critically ill, and (3) had achieved menarche.

Data collection procedure

Before conducting each interview, EHS, the principal investigator of this study, visited all three schools and received permission to conduct the survey and to provide health education to adolescent girls of the corresponding schools. The baseline survey was conducted in April 2012. The questionnaires were drafted in English and then translated into Bangla, the national language of Bangladesh. Back-translation from Bangla to English was done before and after the pretest questionnaires were tested, as a validation exercise. We also modified the questionnaire based on the results of the pretest to make it more understandable and easier for participants to answer.

After completion of the baseline survey, we hired one supervisor, a local Obstetrician and Gynecologist, and 3 research assistants (RAs) with good knowledge of the study's target population. Prior to the survey, we gave 4-days training to RAs and one female school teacher (selected from the corresponding schools) on adolescent health education focusing on menstrual hygiene and on the importance of maintaining the confidentiality of the participants' information. The training was done using a field manual which we developed in the Bangla language. Menstrual education focused on knowledge, beliefs, behaviors, and restrictions on menstrual hygiene and also on menstrual disorders among the adolescent girls. The education materials were developed by our employed OB/GYN and ensured culturally acceptable for the

girls. Twelve 45-minute lessons were delivered by the RAs once every 15 days. Female RAs were recruited for the study, so that adolescent girls would feel comfortable discussing these issues. Furthermore, 12 Focus Group Discussions (FGDs) were conducted in the schools so that RAs and adolescent girls could become well acquainted with each other, as this is a very sensitive topic to discuss in Bangladesh. In addition, FGDs were conducted in order to evaluate the effectiveness of the intervention using a qualitative approach. After six months of intervention, follow-up data collection was carried out in the schools using the same questionnaire as used in the baseline regarding knowledge, beliefs, practices, types of complications, and restrictions on menstrual hygiene. RAs visited the students' houses who were not available at school during the follow-up data collection.

This stud protocol was reviewed and approved by the ethical committee of Bangladesh Medical Research Council (BMRC). Prior to conducting the baseline survey, participants were informed about the study, invited to participate, and informed of their right to decline. Written consent was obtained from the parents and verbal consent was obtained from the Head teacher, class teacher, and participants. In addition, we obtained written permission for this study from the local Education Officer under the Ministry of Education (MoE) in Bangladesh.

Intervention components

Knowledge and beliefs about menstruation

This section of the questionnaire consisted of 10 multiple choice questions to determine pupils' knowledge regarding (1) normal monthly duration of menstruation, (2) poor menstrual hygiene predisposing infection, (3) hygienic practices preventing menstrual pain, (4) menstrual blood being considered impure, (5) proper sanitary products, (6) cause of menstruation, (7)

origin of menstrual blood, (8) age of normal cessation of menstruation, (9) hot or cold food affecting menstrual cycle, and (10) menstruation as an assurance of fertility (fecundity).

The students' knowledge and beliefs were scored using a system adopted from previous studies. [23-25] Each correct response was awarded one point, whereas any incorrect or "don't know" answers attained no mark. This gave a total possible score of 10 points. Respondents that scored 0-3 points were adjudged as having poor knowledge, those with 4-7 points, medium knowledge, and those with 8-10 points were considered to have high knowledge. The *Cronbach* α was 0.73 for knowledge and beliefs instrument.

Practices related to menstrual hygiene

This section of the questionnaire consisted of seven items assessing girls' practices of menstrual hygiene: (1) absorbent used during menstruation, (2) frequency of changing out absorbent per day, (3) drying of used absorbent, (4) storing of washed clothes, (5) methods of displace/disposal of the used absorbent, (6) cleaning of external genitalia, and (7) material used for cleaning of external genitalia.

A score of 2 was given for good hygienic practices, a score of 1 was given for fair practices, and a score of 0 was given for poor practices. The maximum score was ranged from 0-14 points. Students that scored 0-4 points, 5-8 points, and 9+ points under practice were adjudged as having poor, fair, and good practices respectively. The *Cronbach* α was 0.82 for practice instrument.

Menstrual disorders experienced and menstrual behaviors/restrictions

Regarding menstrual disorders experienced by the adolescent, the following items were evaluated: (1) regularity of menstrual cycle, (2) types of complications experienced during menstruation, and (3) consultation with someone for menstrual-related complications. Moreover, this section also consisted of items to assess girls' behaviors and restrictions during menstruation: (1) visits to holy places, (2) visits to relatives, friends, and neighbors, (3) participation in household activities, and (4) school attendance during menses.

Statistical analysis

Data were cross-checked for consistency before final data entry, using Microsoft Excel**.** All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 18 (SPSS Inc., Chicago, IL, USA). Descriptive analyses were conducted to estimate socio-demographic characteristics of the respondents. We used χ^2 analyses to evaluate the impact of an education program on four recurrent themes of menstruation: (i) knowledge and beliefs; (ii) menstrual disorders experienced; (iii) hygiene practices; and (iv) menstruation behavior and restrictions of the school-aged adolescent girls between the baseline and the follow-up period. In all analyses, the level of significance was set at $P<0.05$ (two-tailed).

RESULTS

More than half of the respondents (52.4%) were 11 to 13 years old, 13.7%, and 11.8% of the girls' parents had no education (Table 1). Approximately 95% were Muslim and 41.8% had a household of six or more. Out of 416 participants, 27.9% were defined as being poor, 34.6%

belonged to middle bands of wealth, and 37.5% were defined as being rich. Regarding their house type, 17.1% were lived in *pacca*, 14.4% in *half-pacca*, and 68.5% in *kancha house* (Table 1).

In the pre-test stage, 77.4%, 68.3%, and 67.1% of girls had knowledge regarding the duration of a normal average menstrual cycle (between 21 to 35 days), that poor menstruation can predispose infection, and that hygienic practices during menstruation period can prevent menstrual pain. In the follow-up period, significant increases (P<0.001) were observed in the level of knowledge of these three indicators (93.5%, 95.7%, and 94%). Significant improvement was observed regarding the knowledge that menstrual blood is not impure (67.1% versus 95.9%) and that proper sanitary products should be used for menstrual protection (57.9% versus 81.5%) at the follow up period. There was no statistically significant difference between the baseline and the follow-up period regarding respondents' correct knowledge on the cause of menstruation, origin of menstrual blood, or that menstruation was an assurance of fertility. However, significant differences were also observed concerning the respondents correct knowledge about age of normal cessation of menstruation and that there is no influence of hot and cold foods on menstrual cycle. Overall, significant improvement (P<0.001) was observed regarding high knowledge and beliefs scores at the follow-up period compared with the baseline (51% versus 82.4%; Table 2).

With regards to absorbent used during menstruation, significant improvement was observed (P<0.001) in using sanitary pads during menstruation in the follow-up period (39.2%) compared with the baseline (16.8%; Table 4). Frequency of changing pad/cloths per day and drying absorbent outside the room with sunlight was higher in the follow-up period compared with the baseline. No significant differences were observed in storing of washed clothes between

the baseline and the follow-up period. Methods of disposing the absorbent through burial/burning or through dustbin were significantly higher at the follow-up period compared with the baseline. Significant improvement was observed at the follow-up period in cleaning of genitalia every time the toilet was used or during bathing. It was higher at the follow-up period than at the baseline (Table 3). In addition, no significant differences were observed in material used to clean external genitalia between the baseline and the follow-up period. Regarding the practices grading score, significant improvement (88.9% versus 28.8%) was observed in good practices in the follow-up period compared with the baseline.

A significant difference was observed between the baseline and the follow-up in improving participants' regularity of menstrual cycle (94.5% versus 99.5%) and lowering the experiences of complications during menstruation (78.6% versus 59.6%; Table 3). For the physiological symptoms, a significantly lower number of adolescents experienced excessive bleeding and greasy skin at the follow-up period compared with the baseline. Regarding dysmenorrheal complexity, significantly lower numbers of adolescents reported experiencing abdominal pain and nausea and or vomiting at the follow-up period. With regard to psychological symptoms, significant differences were observed in experiencing discomfort, stress, and depression between baseline and follow-up period. At the follow-up period, respondents were significantly more likely to consult someone for menstrual related complications than at the baseline (99.8% versus 90.8%; Table 4).

During the baseline survey, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% of girls reported that they did not attend school during menstruation (Table 4). In the follow-up period, significant improvements were observed with

regard to restrictions followed by them. No significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses.

DISCUSSION

To the best of our knowledge, this is the first study to evaluate school-based menstrual educational intervention on knowledge, beliefs, and practices of school-aged adolescent girls in Bangladesh. The present study demonstrates that the knowledge and beliefs regarding menstrual hygiene was low before the implementation of the program. After implementation of the program, there was a significant increase in knowledge among the adolescents, from 51% to 82.4%. This finding coincides with those of other studies in Saudi Arabia and Egypt which revealed the same results. [26-27]

Hygiene related practices during menstruation are of considerable importance as it affects health by increasing vulnerability to infection especially infections of the urinary tract and perineum. [4] Good hygiene, such as the use of sanitary pads and adequate washing of genital area, is essential during menstruation. [4-6] Girls of reproductive age need access to clean and soft absorbent sanitary products, which in the long run protects their health. In the present study, during the pre-intervention phase, only 28.8% of adolescents had good hygiene practices. In the post-intervention phase, there was a significant improvement in good menstrual practices (60.1%). Various studies have shown that health education increases knowledge and positive attitudes towards puberty as a natural physiological phenomenon. [28]

Regarding menstrual disorders among adolescent girls, in the pre-intervention phase 10.6% and 6.7% of adolescents suffered from excessive bleeding and greasy skin. After implementation of the health education program, there was a significant reduction observed

regarding such disorders. Dysmenorrhoea is a very common problem among adolescent girls; it affects their quality of life. In the pre-intervention phase 61.5% and 4.6% of adolescents suffered from abdominal pain, nausea, and vomiting; this result is similar to the study done in Egypt. [27] In addition to that, dysmenorrhea (pain during menses) was reported by almost all students in this study, in which 59.8% of them had severe pain followed by back ache and fatigue. This result matched with a study done among Malaysian school girls in 2009. [30] However, after the health education program, significant reductions were observed. Regarding psychological symptoms, discomfort and stress rate also changed significantly at the follow up period. At the follow-up period, they were more likely to consult someone about menstrual related complications than at the baseline (99.8% versus 90.8%).

During the pre-intervention phase, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% girls reported that they did not attend school during menstruation. In the follow-up, significant improvements were observed with regard to the restrictions followed by them. However, no significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses. These findings therefore illustrate that, there are still greater influences of socio-cultural beliefs and taboos regarding menstruation. Different types of restrictions practiced during menstruation were also reported by one Indian study [5] where girls do not perform any household work during the menses.

This intervention study provides several important findings and insights for adolescent girls. However, the study had several limitations. First, findings of this study were based on self-reported outcomes and may therefore differ from actual behavior. Adolescents may have over-reported their use of good menstrual hygiene practices in order to please the interviewer.

However, all the participants joined the health education session regularly. Second, information about the complications was obtained from the participants, and not from medical records due to time and budget limits, therefore, bias could have occurred that may have affected the reliability of the data. However, our trained RAs received training from physicians in order to collect such information in a reliable manner. Finally, although all possible efforts were made to standardize the educational intervention, it is possible that other environmental factors such as differences in the abilities of RAs and their ability to disseminate study messages could affect the study outcome. Despite such limitations, the results of the present study provide important findings for policy makers to make rational decisions on improving adolescent reproductive health in Bangladesh.

CONCLUSIONS AND RECOMMNEDATION

These results document the feasibility of implementing a health education program on menstrual hygiene in secondary schools serving rural Bangladesh. The program produced significant positive changes in knowledge, beliefs, practices, disorder experiences, and behavior or restrictions regarding menstrual hygiene. More intense or longer interventions may be needed to significantly improve good menstrual hygiene practices in this population. Taking into account the health implications and prevailing socio-cultural and economic factors, there is also an urgent need for intensifying effective strategies to persuade the adolescent school girls to adopt healthy menstrual practices. A well-informed continuous, school education program should be imparted to the students. In addition, the findings emphasize the inclusion of safe hygiene and sanitary practices that should be included in the school curricula as well as greater communication between female students and teachers and between daughters and mothers.

Acknowledgments This research was supported by 'Honjo International Scholarship Foundation', Japan. The authors would like to thank them for their financial contribution to this important study. We also wish to thank all participants, teachers, and education officers who aided in conducting this research. Finally, we must thank Dr. Nowsheen Sharmin Purabi, Register Gyn. and Obst. at Anwer Khan Medical College, Dhaka, Bangladesh for her training and support for the Research Assistants which made it possible to conduct this research.

Contributors EHS and SK develop the proposal and implement the study. KI and MM was involved in the field study. MR and EHS did the analyses and wrote the manuscript. All authors checked and approved the final manuscript.

Funding This study was funded by "Honjo International Scholarship Foundation', Japan.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

REFERENCES

1. World Health Organization. Adolescent friendly health services. An agenda for change. *World Health Organization*. Geneva: 2002.

2. Marianne E, McPherson E, Korfine L. Menstruation across time: menarche, menstrual attitudes, experiences and behaviors. *Women's Health Issues* 2004; 14: 193-200.

3. Uzochukwu UA, Patricia NA, Theophilus ON. The impact of pre-menarcheal training on menstrual practices and hygiene of Nigerian school girls. *Pan Afr Med J* 2009; 22:9.

4. Rokeya A, Kabita Y. Menstrual hygiene: breaking the silence. *Water Aid Bangladesh* 2007; 283-87.

5. Dasgupta A, Sarkar M. Menstrual hygiene: How Hygienic is the Adolescent Girl? *Indian J Comm Med* 2008; 33:77-80.

6. Menstrual Hygiene. Feminine Hygiene, Gynaecology and Menstruation Information, Resources and Pro-sducts for Dads and Husband. http://www.mens-trualhygiene.com

7. Ayalew T, Meseret Y, Yeshigeta G. Reproductive Health Knowledge and Attitude among Adolescents: A community based study in Jimma Town, Southwest Ethiopia. *Ethiop J Health Dev* 2008; 22(3): 243-251.

8. Suneela G, Nandini S, Ragini S. Socio-cultural Aspects of Menstruation in an Urban Slum in Delhi, India. *Reprod Health Matters* 2001; 9 (17): 16-25.

9. Olayinka OO & Akinyinka OO. Unmet Need for Sexuality Education among Adolescent Girls in Southwest Nigeria: A Qualitative Analysis. *Afr J Reprod Health* 2004; 8 (3): 27-37.

10. Ahuja A, Tiwari S. Awareness about pubertal changes among adolescent girls. *Journal of Family Welfare* 1995; 41(1): 46-50.

11. Chaudhari RH. Socio-economic demographic and reproductive health profile of adolescents in the SAARC countries. Paper presented in south Asia Conference on Adolescents; 21-23 July 1998; New Delhi, India.

12. Khanna A, Goyal RS, Bhawsar R. Menstrual practices and reproductive problems: A study of adolescent girls in Rajasthan. *Journal of Health Management* 2005; 7(1): 91-97.

13. Mudey AB, Keshwani N, Mudey GA, Goyal RC. A cross-sectional study on the awareness regarding safe and hygienic practices amongst school going adolescent girls in the rural areas of Wardha district. *Global Journal of Health Science* 2010; 2(2): 225-231.

14. Bhatia JC, Cleland J. Self-reported symptoms of gynecological morbidity and their treatment in south India. *Studies in Family Planning*1995; 26(4): 491-495.

15. Mehara S. (Ed), Adolescent Girl: An Indian perspective. MAMTA Health Institute for Mother and Child, Saket, New Delhi. 1995: pp. 75-78.

16. Ghattargi CH, Deo DS. Preparation and Practices regarding Menstruation: A comparative study in Rural and Urban Adolescent Girls. *Indian J of Comm Med* 2005; 30(1): 10-14.

17. Singh AJ. The place of menstruation in the reproductive lives of women of rural north India. *Indian J of Comm Med* 2006; 31(1):10-14.

18. Kabir B, Barua MK & Ahmed M. Improving menstrual hygiene facilities in secondary schools Initiatives from BRAC-WASH Program. Dhaka, Bangladesh, 31 January -2 February 2012.

19. Ali A, Mahmud SN, Karim A, et al. Knowledge and practice of NFPE-AGG graduates regarding menstruation. Dhaka: Bangladesh Rural Advancement Committee, 1996.

20. Devi DK & Ramaiah VP. A study on menstrual hygiene among rural adolescent girls. Indian *J of Med Sci* 1994; 48: 139-143.

21. Narayan KA, Srinivasa DK, Pelto PJ, Veerammal S. Puberty rituals, reproductive knowledge and health of adolescent school girls in South India. *AP Pop Jour* 2001; 16: 225-238.

22. Bangladesh Bureau of Statistics (BBS), 2007. *BBS Report* 2007.

23. Lawan UM, Yusuf NW, Musa AB. Menstruation and Menstrual Hygiene amongst Adolescent School Girls in Kano, Northwestern Nigeria. *Afr J of Reprod Health* 2010; 14(3): 201-207.

24. Anju A, Patil R. Menstrual Hygiene and Practices of Rural Adolescent Girls of Raichur. Int J *Biol Med Res* 2013; 4(2): 3014- 3017.

25. El-Gilany AH, Badawi K, El-Fedawy S. Menstrual Hygiene among Adolescent School girls in Mansoura, Egypt. *Reprod Health Matters* 2005; 13(26):147–152.

26. Ayafi SA. Factors associated with health behavior regarding menstruation among Saudi intermediate school girls in Riyadh city. Master thesis, Nursing College, King Saud University 1999.

27. Hassanen H, Tosson M, El-Elkareem EA. Effect of health education and training program for secondary school students on menstruation at Assiut Governorate. *Bulletin of High Institute of Public Health* 2004; 34 (3): 575-94.

28. Afzali M & Allameh R. Study of educational needs of 12-14 years old girls about adolescent health and determines appropriate and effective strategies for adolescent health education. *Koomesh* 2000; 1(2):39-47.

29. Eswi A, Helal H, Elarousy W. Menstrual attitude and knowledge among Egyptian female adolescents. *J of Am Sci* 2012; 8 (6): 555-565.

30. Lee K, Chen Y, Lee K, Kaur J. Menstruation among adolescent girls in Malaysia: a cross-sectional school survey. *Singapore Medical Journal* 2006; 47: 869-874.

Table 1: Socio-demographic characteristics of the participants (n=416)

Characteristic	Number (n)	Percentage (%)
Age, years		
11-12	64	15.4
13	154	37.0
14+	198	47.6
Religion		
Muslim	394	94.7
Non-Muslim	22	5.3
Father's education		
No education	57	13.7
Incomplete primary	176	42.3
Complete primary	94	22.6
Secondary or higher	89	21.4
Mother's education		
No education	49	11.8
Incomplete primary	173	41.6
Complete primary	119	28.6
Secondary or higher	75	18.0
Household size		
2-4	116	27.9
5	126	30.3
6+	174	41.8
House type		
Pacca	71	17.1
Half-pacca	60	14.4
Kancha	285	68.5
Wealth Index[a]		
Poor	116	27.9
Middle	144	34.6
Rich	156	37.5

[a]Constructed from data on household assets, including ownership of durable goods (such as televisions and bicycles) and dwelling characteristics (such as source of drinking water, sanitation facilities, and construction. We used principal components analyses to assign individual household wealth scores.

Pacca means brick-built; *Half-pacca* means only floor is brick-built and no brick in the roof; *Kancha* means no brick in the house.

Table 2: Impact of menstrual educational program on correct menstruation knowledge and beliefs (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Duration of normal menstruation cycle	322	77.4	389	93.5	16.1	**<0.001**
Poor menstruation hygiene predispose to infection	284	68.3	398	95.7	27.4	**<0.001**
Hygiene can prevent menstrual pain	279	67.1	391	94.0	26.9	**<0.001**
Menstruation blood is impure	279	67.1	399	95.9	28.8	**<0.001**
Proper sanitary products should use for menstruation protection	241	57.9	339	81.5	23.6	**<0.001**
Cause of menstruation	334	80.3	353	84.8	4.5	0.676
Origin of menstruation blood	41	9.9	55	13.2	3.3	0.897
Age of normal cessation of menstruation	245	58.9	352	84.6	25.7	**<0.001**
Influence of hot or cold food on menses	273	65.6	358	86.1	20.5	**<0.001**
As an assured fertility (fecundity)	179	43.0	190	45.7	2.7	0.346
Knowledge and beliefs grading						
Poor (0-3)	120	28.8	7	1.7	-27.1	**<0.001**
Medium (4-7)	84	20.2	66	15.9	-4.3	
High (8-10)	212	51.0	343	82.4	31.4	

Table 3: Impact of menstrual educational program on menstrual hygienic practices by adolescent girls (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Absorbent used during menstruation						
Sanitary pad	70	16.8	163	39.2	22.4	**<0.001**
New cloths	207	49.8	209	50.2	0.4	
Old cloths/others	139	33.4	44	10.6	-22.8	
Frequency of changing pad/cloths per day						
4+ times	35	8.4	321	77.2	68.8	**<0.001**
2-3 times	322	77.4	93	22.4	-55.0	
1 time	59	14.2	2	0.5	-13.7	
Drying of used absorbent						
Outside room with sunlight	78	18.8	401	96.4	77.6	**<0.001**
Inside room with sunlight	46	11.1	5	1.2	-9.9	
Inside/outside room without sunlight	292	70.1	10	2.4	-67.7	
Storing of washed clothes						
Clean and covered place[a]	159	38.2	170	40.8	2.6	0.089
Clean and open space[b]	104	25.0	85	20.4	-4.6	
Unclean and open/covered place[c]	153	36.8	129	31.0	-5.8	
Methods of displace/dispose						
Buried/burn/dustbin	235	56.5	341	82.0	25.5	**<0.001**
Latrine	65	15.6	49	11.8	-3.8	
Throw on the roads	116	27.9	26	6.2	-21.7	
Cleaning of genitalia						
Every time during toilet use	65	15.6	145	34.8	19.2	**<0.001**
During bathing	202	48.6	254	61.1	12.5	
Do not clean	149	35.8	17	4.1	-31.7	
Material used for cleaning of External genitalia						
Water and antiseptic	30	7.2	45	10.8	3.6	0.238
Soap and Water	199	47.8	191	45.9	-1.9	
Only water/not cleaning	187	45.0	180	43.2	-1.8	
Practice grading						
Poor (0-4)	60	14.4	3	0.7	-13.7	**<0.001**
Fair (5-8)	236	56.8	43	10.3	-46.5	
Good (9+)	120	28.8	370	88.9	60.1	

[a]Suit case, box, cupboard, and shopper; [b]Store room, anywhere in the room, under cushion, under the bed, behind the door, within the washroom; [c]Gallery, under the kitchen roof, anywhere in the room, under cushion, under the bed, behind the door, within the washroom.

Table 4: Impact of menstrual educational program on menstrual disordered experienced, behaviors and restrictions (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Menstrual disorders experienced						
Regularity of menstruation	393	94.5	414	99.5	5.0	**0.023**
Complications during menstruation	327	78.6	248	59.6	-19.0	**<0.001**
Types of complications during menstruation						
Physiological symptoms						
Excessive bleeding	44	10.6	13	3.1	-7.5	**<0.001**
Headache	32	7.7	28	6.7	-1.0	0.689
Increase appetite	26	6.2	18	4.3	-1.9	0.277
Greasy skin	28	6.7	6	1.4	-5.3	**0.002**
Dysmenorrhea						
Abdominal pain	256	61.5	219	52.6	-8.9	**0.012**
Nausea and vomiting	19	4.6	6	1.4	-3.2	**0.015**
Back pain	29	7.0	19	4.6	-2.4	0.054
Psychological symptoms						
Discomfort	35	8.4	13	3.1	-5.3	**0.002**
Stress	22	5.3	3	0.7	-4.6	**0.003**
Irritability	16	3.8	6	1.4	-2.4	0.052
Depression	18	4.3	3	0.7	-3.6	**0.002**
Consult with someone for menstruation related complications	378	90.8	415	99.8	9.0	**0.003**
Behaviors and restrictions						
Visit relatives, friends, and neighbors during menses						
No	189	45.4	110	26.4	-19.0	**0.002**
Yes	227	54.6	306	73.6	19.0	
Doing household activities during menses						
No	94	22.6	85	20.4	-2.2	0.238
Yes	322	77.4	331	79.6	2.2	
Attending school						
No	32	7.7	11	2.6	-5.1	**0.018**
Yes	384	92.3	405	97.4	5.1	

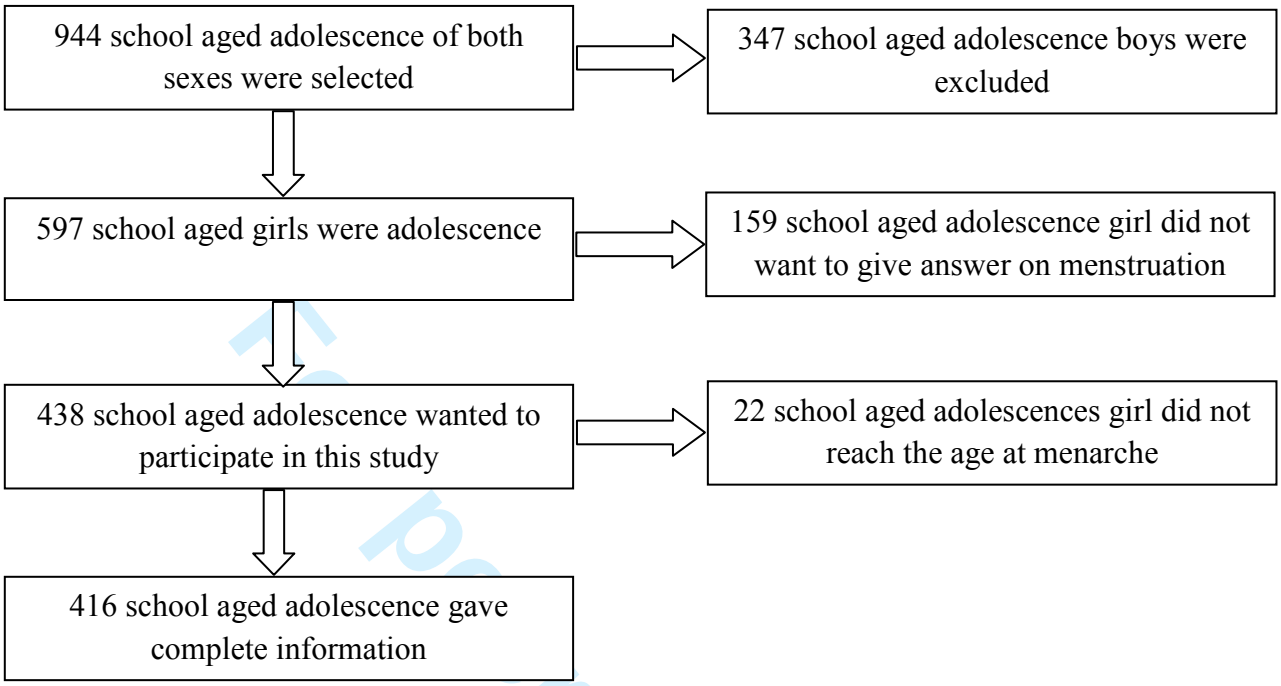


Figure 1: Selection of sample.

BMJ Open

Effect of school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2013-004607.R1
Article Type:	Research
Date Submitted by the Author:	02-May-2014
Complete List of Authors:	Haque, Syed; United Nations University-International Institute for Global Health (UNU-IIGH), ; UChicago Research Bangladesh, Rahman, Mosiur; International Health Section, Division of Public Health, Graduate School of Tokyo Medical and Dental University, Itsuko, Kawashima; Honjo International Scholarship Foundation, 1-14-9 Tomigaya, Tokyo 151-0063, Japan, Mutahara, Mahmuda; Wageningen University, Netherlands, Kayako, Sakisaka; Chuo University, Faculty of Policy Studies
Primary Subject Heading:	Public health
Secondary Subject Heading:	Global health
Keywords:	Epidemiology < TROPICAL MEDICINE, EPIDEMIOLOGY, Reproductive medicine < GYNAECOLOGY

Effect of school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh

Syed Emdadul Haque,[1, 6*] Mosiur Rahman,[2] Kawashima Itsuko,[3] Mahmuda Mutahara,[4] Kayako Sakisaka [5]

[1]UChicago Research Bangladesh, Dhaka, Bangladesh

[2]International Health and Medicine, Division of Public Health, Graduate School of Medicine, Tokyo Medical and Dental University, Tokyo, Japan

[3]Honjo International Scholarship Foundation, 1-14-9 Tomigaya, Tokyo 151-0063, Japan

[4]Wageningen University, Netherlands

[5]Faculty of Policy Studies, Chuo University, Japan

[6]United Nations University-International Institute for Global Health (UNU-IIGH), Malaysia

***Correspondence author:**
Dr Syed Emdadul Haque
UChicago Research Bangladesh
House #4, Road #2/B, Sector #4, Uttra-1230
Dhaka, Bangladesh
Email address: emdad91@gmail.com; emadad@urb-bd.org; syed.emdadul@unu.edu

ABSTRACT

Objectives: To assess the impact of a school-based menstrual education program on (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) restrictions and behaviors practiced.

Design: Intervention study.

Setting: Araihazar area in Bangladesh.

Participants: 416 adolescent female students (grades 6-8) and aged between 11-16 years old living with their parents.

Interventions: This school-based health education study was conducted during April 2012 to April 2013.

Primary and secondary outcome measure: Out of 26 high schools in the study area, we randomly selected 3 schools. We delivered six months of educational intervention by trained (TOT by certified OB/GYN) Research Assistants (RAs) on menstrual hygiene among school girls. RAs read the questionnaire and participants answered by them. The changes in knowledge, beliefs, practices, menstrual disorders experienced, and restrictions and behaviors practiced toward menstrual hygiene were compared between the baseline and the follow-up.

Results: Significant improvement (P<0.001) was observed regarding high knowledge and beliefs scores at the follow-up compared with the baseline (51% versus 82.4%). Significant improvement was also observed in overall good menstrual practices (28.8% versus 88.9%) including improvement in using sanitary pads (22.4%), frequency of changing pad/cloths per day (68.8%), drying absorbent (77.6%), methods of disposing the absorbent (25.5%), and cleaning of genitalia (19.2%). During the follow-up, we observed a significant difference in improving participants' regularity of menstrual cycle (94.5% versus 99.5%) and lowering the experiences of complications during menstruation (78.6% versus 59.6%).

Conclusions: The program produced significant changes in the knowledge, beliefs, practices, complications, and behavior or restrictions regarding menstrual hygiene. These results document the feasibility of implementing a health education program for adolescents on menstrual hygiene in secondary schools serving rural Bangladesh.

Keywords: School-based health education; menstrual hygiene; adolescent girls; Bangladesh.

Strengths and limitations of this study

- This is the first evaluation study of menstrual educational program among adolescent school girls in Bangladesh.
- This study evaluated menstrual knowledge, beliefs, and practices of the students of grade 6-8 in Bangladesh. We also evaluated menstrual disorders experienced by the adolescents.
- The educational program showed significant increases on knowledge (51% to 82.4%), belief, and practices (28.8% to 88.9%).
- Significant improvements were also observed with regards to the restrictions on visits to relatives, friends, and attending school during the menstruation.
- The same educational program should implement for all adolescent girls in Bangladesh.

INTRODUCTION

Adolescence is a period of rapid transition in life from girlhood to womanhood. The onset of menstruation is one of the most important changes that occur for girls during the adolescent years.[1] The first menstruation (menarche) occurs between the ages of 11 and 15. [2-3] Poor menstrual hygiene and inadequate self-care are major determinants of morbidity and other complications among this age group such as urinary tract infections, scabies in the vaginal area, abnormal abdominal pain, complications during pregnancy, and absence from schools. [4-7] On the other hand, many parts of developing countries a culture of silence surrounds the topic of menstruation and related issues. [8-9] As a result, many young girls lack appropriate and sufficient information regarding menstrual hygiene. Infections due to lack of hygiene during menstruation have been reported in many studies. [10-15] They also revealed that most adolescent girls had incomplete and inaccurate information about menstrual physiology and hygiene. The menstrual information they did have was acquired primarily through mothers, television, friends, teachers, and relatives. [5, 16-17]

Menstruation is still regarded as something unclean or dirty in Bangladeshi society. [4] Because of various myths, misconceptions, and restrictions practiced during menstruation, adolescent girls in Bangladesh often develop negative attitudes towards this natural physiological phenomenon. The majority of girls lack scientific knowledge about menstruation and puberty. [18] Adolescent girls in Bangladesh are often reluctant to discuss this topic with their parents and hesitant to seek help regarding their menstrual problems. Most girls are not informed about menarche or how to manage menstrual bleeding. [18] Studies in rural Bangladesh and India found that 69.0% of adolescent girls were using old pieces of cloth or even no protection at all during menstruation. [19-20] Therefore, the need to create awareness and increase access to the requisite

sanitary infrastructure related to menstrual hygiene is important for school-aged adolescents in Bangladesh.

Learning menstrual hygiene is a vital part of health education for adolescent' girls so they can carry on regular work/habits throughout their adult life. [21] The ideal menstrual health education curriculum would encourage students to think about the relationships between knowledge, choice, behaviors, and enhanced human health. However, despite the apparent need to achieve several millennium development goals (MDGs), to our knowledge no study has been conducted on menstrual hygiene educational intervention among school girls in Bangladesh. Therefore, the present study was designed to evaluate the effectiveness of a school-based menstrual educational program regarding (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) the restrictions and behaviors practices by 6-8 grade school girls in Bangladesh.

METHODS

Study design and participants

This intervention study was conducted in Araihazar Thana, located at the Narayanganj District in Bangladesh. Araihazar Thana is located 25 km south-east of the capital, Dhaka. The total area of this Thana is 183.35 km² with 63,080 household units and a population of 331,556. Males constitute 51.7% of the population, and females 48.3%. Araihazar has an average literacy rate of 53.0% (7+ years of formal education), compared to the national average JJ

Out of 26 high schools (grade 6-10) in the study area, we randomly selected three schools for this study. From these three schools, one was girls-only and the other two were co-educational. The socioeconomics, cultural norms, religions, and geographical locations of these schools were

very similar to each other but not adjacent. In those three schools, 597 school aged girls were adolescence. Out of 597, 438 were willing to join in the study. However, 22 school aged girl did not reach the age at menarche. Therefore, the final participants were 416 (Figure 1). Participants were selected using the following criteria: (1) they were within grades 6-8, (2) not critically ill, and (3) had achieved menarche. Participants aged were between 11-16 years old and they were living with their parents.

Data collection procedure

Before conducting each interview, SEH, the principal investigator of this study, visited all three schools and received permission to conduct the survey and to provide health education to adolescent girls of the corresponding schools. After the permission, we conducted a pilot survey of the questionnaire and revised as suggested for the final survey. The questionnaires were drafted in English and then translated into Bangla, the national language of Bangladesh. Back-translation from Bangla to English was done before and after the pretest questionnaires were tested, as a validation exercise. We also modified the questionnaire based on the results of the pre-test to make it more understandable and easier for participants to answer. The baseline survey was conducted in April 2012. Trained RAs read loudly the questions and the answer was given by the participants.

After completion of the baseline survey, we hired one supervisor, a local Obstetrician and Gynecologist, and 3 research assistants (RAs) with good knowledge of the study's target population. Prior to the survey, we gave 4-days training to RAs and one female school teacher (selected from the corresponding schools) on adolescent health education focusing on menstrual hygiene and on the importance of maintaining the confidentiality of the participants'

information. The training was done using a field manual which we developed in the Bangla language. Menstrual education focused on knowledge, beliefs, behaviors, and restrictions on menstrual hygiene and also on menstrual disorders among the adolescent girls. The education materials were developed by our employed OB/GYN and ensured culturally acceptable for the girls. Twelve 45-minute lessons were delivered by the RAs once every 15 days. Female RAs were recruited for the study, so that adolescent girls would feel comfortable discussing these issues. Furthermore, 12 Focus Group Discussions (FGDs) were conducted in the schools so that RAs and adolescent girls could become well acquainted with each other, as this is a very sensitive topic to discuss in Bangladesh. In addition, FGDs were conducted in order to evaluate the effectiveness of the intervention using a qualitative approach. After six months of intervention, follow-up data collection was carried out in the schools using the same questionnaire as used in the baseline regarding knowledge, beliefs, practices, types of complications, and restrictions on menstrual hygiene. RAs visited the students' houses who were not available at school during the follow-up data collection.

This study protocol was reviewed and approved by the ethical committee of Bangladesh Medical Research Council (BMRC). Prior to conducting the baseline survey, participants were informed about the study, invited to participate, and informed of their right to decline. Written consent was obtained from the parents and verbal consent was obtained from the Head teacher, class teacher, and participants. In addition, we obtained written permission for this study from the local Education Officer under the Ministry of Education (MoE) in Bangladesh.

Measures

Intervention components

Knowledge and beliefs about menstruation

This section of the questionnaire consisted of 10 multiple choice questions to determine pupils' knowledge regarding (1) normal monthly duration of menstruation, (2) poor menstrual hygiene predisposing infection, (3) hygienic practices preventing menstrual pain, (4) menstrual blood being considered impure, (5) proper sanitary products, (6) cause of menstruation, (7) origin of menstrual blood, (8) age of normal cessation of menstruation, (9) hot or cold food affecting menstrual cycle, and (10) menstruation as an assurance of fertility (fecundity).

The students' knowledge and beliefs were scored using a system adopted from previous studies. [23-25] Each correct response was awarded one point, whereas any incorrect or "don't know" answers attained no mark. This gave a total possible score of 10 points. Respondents that scored 0-3 points were adjudged as having poor knowledge, those with 4-7 points, medium knowledge, and those with 8-10 points were considered to have high knowledge. The *Cronbach* α was 0.73 for knowledge and beliefs instrument.

Practices related to menstrual hygiene

This section of the questionnaire consisted of seven items assessing girls' practices of menstrual hygiene: (1) absorbent used during menstruation, (2) frequency of changing out absorbent per day, (3) drying of used absorbent, (4) storing of washed clothes, (5) methods of displace/disposal of the used absorbent, (6) cleaning of external genitalia, and (7) material used for cleaning of external genitalia. A score of 2 was given for good hygienic practices, a score of 1 was given for fair practices, and a score of 0 was given for poor practices. The maximum score was ranged

from 0-14 points. Students that scored 0-4 points, 5-8 points, and 9+ points under practice were adjudged as having poor, fair, and good practices respectively. The *Cronbach* α was 0.82 for practice instrument.

Menstrual disorders experienced and menstrual behaviors/restrictions

Regarding menstrual disorders experienced by the adolescent, the following items were evaluated: (1) regularity of menstrual cycle, (2) types of complications experienced during menstruation, and (3) consultation with someone for menstrual-related complications. Moreover, this section also consisted of items to assess girls' behaviors and restrictions during menstruation: (1) visits to holy places, (2) visits to relatives, friends, and neighbors, (3) participation in household activities, and (4) school attendance during menses. Dysmenorrhea was considered as pain in the abdominal, groin and lumbar regions on the day before or on the first day of menstruation. [26] We also assessed adolescent depression using Children Depression Inventory (CDI). [27] The CDI consists of feelings and ideas grouped into 27 items. The scale scores range from 0 to 54. The *Cronbach α* was 0 .73 for this study. We followed a cut-off score ≥ 20 as depressed. [28-29]

Stress was measured using validated Perceived Stress Scale-10 (PSS). [30-31] The PSS scale scores range was from 0 to 40 with high score represents high social stress. The *Cronbach α* was 0.75. A cut-off score of greater than the median ≥ 20 was considered as high stress mood. [29]

Statistical analysis

Data were cross-checked for consistency before final data entry, using Microsoft Excel**.** All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 18 (SPSS Inc., Chicago, IL, USA). Descriptive analyses were conducted to estimate socio-demographic characteristics of the respondents. We used McNemar's Chi-square analyses as because the same individuals are measured (before and after the survey) twice to evaluate the impact of an education program on four recurrent themes of menstruation: (i) knowledge and beliefs; (ii) menstrual disorders experienced; (iii) hygiene practices; and (iv) menstruation behavior and restrictions of the school-aged adolescent girls between the baseline and the follow-up period. In all analyses, the level of significance was set at $P<0.05$ (two-tailed).

RESULTS

More than half of the respondents (52.4%) were 11 to 13 years old, 13.7%, and 11.8% of the girls' parents had no education (Table 1). Approximately 95% were Muslim and 41.8% had a household of six or more. Out of 416 participants, 27.9% were defined as being poor, 34.6% belonged to middle bands of wealth, and 37.5% were defined as being rich. Regarding their house type, 17.1% were lived in *pacca*, 14.4% in *half-pacca*, and 68.5% in *kancha house* (Table 1).

In the pre-test stage, 77.4%, 68.3%, and 67.1% of girls had knowledge regarding the duration of a normal average menstrual cycle (between 21 to 35 days), that poor menstruation can predispose infection, and that hygienic practices during menstruation period can prevent

menstrual pain. In the follow-up period, significant increases (P<0.001) were observed in the level of knowledge of these three indicators (93.5%, 95.7%, and 94%). Significant improvement was observed regarding the knowledge that menstrual blood is not impure (67.1% vs 95.9%) and that proper sanitary products should be used for menstrual protection (57.9% vs 81.5%) at the follow up period. There was no statistically significant difference between the baseline and the follow-up period regarding respondents' correct knowledge on the cause of menstruation, origin of menstrual blood, or that menstruation was an assurance of fertility. However, significant differences were also observed concerning the respondents correct knowledge about age of normal cessation of menstruation and that there is no influence of hot and cold foods on menstrual cycle. Overall, significant improvement (P<0.001) was observed regarding high knowledge and beliefs scores at the follow-up period compared with the baseline (51% vs 82.4%; Table 2).

With regards to absorbent used during menstruation, significant improvement was observed (P<0.001) in using sanitary pads during menstruation in the follow-up period (39.2%) compared with the baseline (16.8%; Table 4). Frequency of changing pad/cloths per day and drying absorbent outside the room with sunlight was higher in the follow-up period compared with the baseline. No significant differences were observed in storing of washed clothes between the baseline and the follow-up period. Methods of disposing the absorbent through burial/burning or through dustbin were significantly higher at the follow-up period compared with the baseline. Significant improvement was observed at the follow-up period in cleaning of genitalia every time the toilet was used or during bathing. It was higher at the follow-up period than at the baseline (Table 3). In addition, no significant differences were observed in material used to clean external genitalia between the baseline and the follow-up period. Regarding the practices grading

score, significant improvement (88.9% vs 28.8%) was observed in good practices in the follow-up period compared with the baseline.

A significant difference was observed between the baseline and the follow-up in improving participants' regularity of menstrual cycle (94.5% vs 99.5%) and lowering the experiences of complications during menstruation (78.6% vs 59.6%; Table 3). For the physiological symptoms, a significantly lower number of adolescents experienced excessive bleeding and greasy skin at the follow-up period compared with the baseline. Regarding dysmenorrheal complexity, significantly lower numbers of adolescents reported experiencing abdominal pain and nausea and or vomiting at the follow-up period. With regard to psychological symptoms, significant differences were observed in experiencing discomfort, stress, and depression between baseline and follow-up period. At the follow-up period, respondents were significantly more likely to consult someone for menstrual related complications than at the baseline (99.8% vs 90.8%; Table 4). During the baseline survey, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% of girls reported that they did not attend school during menstruation (Table 4). In the follow-up period, significant improvements were observed with regard to restrictions followed by them. No significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses.

DISCUSSION

To the best of our knowledge, this is the first study to evaluate school-based menstrual educational intervention on knowledge, beliefs, and practices of school-aged adolescent girls in Bangladesh. The present study demonstrates that the knowledge and beliefs regarding menstrual hygiene was low before the implementation of the program. After implementation of the

program, there was a significant increase in knowledge among the adolescents, from 51% to 82.4%. This finding coincides with those of other studies in Saudi Arabia and Egypt which revealed the same results. [32-33]

Hygiene related practices during menstruation are of considerable importance as it affects health by increasing vulnerability to infection especially infections of the urinary tract and perineum. [4] Poor menstrual hygiene management also effects on reproductive tract infection (RTI). In this study, only 22.4% of girls are using pad even after the health education. The rest are using poor quality cloths. The cloths are colored using toxic elements which might make them to uterine pain. On the other hand, they dry the cloths inside the room which might effects also. Good hygiene, such as the use of sanitary pads and adequate washing of genital area, is essential during menstruation. [4-6] Girls of reproductive age need access to clean and soft absorbent sanitary products, which in the long run protects their health. In the present study, during the pre-intervention phase, only 28.8% of adolescents had good hygiene practices. In the post-intervention phase, there was a significant improvement in good menstrual practices (60.1%). Various studies have shown that health education increases knowledge and positive attitudes towards puberty as a natural physiological phenomenon. [34]

Regarding menstrual disorders among adolescent girls, in the pre-intervention phase 10.6% and 6.7% of adolescents suffered from excessive bleeding and greasy skin. After implementation of the health education program, there was a significant reduction observed regarding such disorders. Dysmenorrhoea is a very common problem among adolescent girls; it affects their quality of life. In the pre-intervention phase 61.5% and 4.6% of adolescents suffered from abdominal pain, nausea, and vomiting; this result is similar to the study done in Egypt. [33, 35] In addition to that, dysmenorrhea (pain during menses) was reported by almost all students in this

study, in which 59.8% of them had severe pain followed by back ache and fatigue. This result matched with a study done among Malaysian school girls in 2009. [36] The use of oral contraceptives and hot drinking water may suppress ovulation and reduce menstrual fluid prostaglandin (PG) activity levels which are responsible for the occurrence of dysmenorrheal. Moreover, regular exercise can induce amenorrhea and it may decrease symptoms of dysmeorhhoea. [37] Regarding psychological symptoms, discomfort and stress rate also changed significantly at the follow up period. At the follow-up period, they were more likely to consult someone about menstrual related complications than at the baseline (99.8% vs 90.8%).

During the pre-intervention phase, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% girls reported that they did not attend school during menstruation. In the follow-up, significant improvements were observed with regard to the restrictions followed by them. However, no significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses. These findings therefore illustrate that, there are still greater influences of socio-cultural beliefs and taboos regarding menstruation. Different types of restrictions practiced during menstruation were also reported by one Indian study [5] where girls do not perform any household work during the menses.

This intervention study provides several important findings and insights for adolescent girls. However, the study had several limitations. First, findings of this study were based on self-reported outcomes and may therefore differ from actual behavior. Adolescents may have over-reported their use of good menstrual hygiene practices in order to satisfy the interviewer. However, all the participants joined the health education session regularly. Second, information about the complications was obtained from the participants, and not from medical records due to

time and budget limits, therefore, bias could have occurred that may have affected the reliability of the data. However, our trained RAs received training from physicians in order to collect such information in a reliable manner. Third, although adolescents, who experienced pain in the abdominal, groin and lumbar regions on the day before or on the first day of menstruation, were considered as dysmenorrhea in this study, however, we could assess the degree of pain by utilizing scale. In future we will certainly consider this point. Fourth, this study concluded that education regarding menses has a beneficial impact for the young women in improving normal menstrual cycle. However, it may be possible that, within the passage of time in this young age group would allow more girls to achieve ovulatory and hence regular cycles - so it may be possible that time may help to done this, not the education. A control group of girls of a similar age would be helpful to answer the questionnaire. Fifth, we claimed that improper menstrual hygiene can increase the risk of UTI. However, there is no data to say that UTIs are increased due to external hygiene issues. One cause might be that the used cloths mostly are colored and contains toxic elements which might make them to uterine pain.

Finally, although all possible efforts were made to standardize the educational intervention, it is possible that other environmental factors such as differences in the abilities of RAs and their ability to disseminate study messages could affect the study outcome. Despite such limitations, the results of the present study provide important findings for policy makers to make rational decisions on improving adolescent reproductive health in Bangladesh.

CONCLUSIONS AND RECOMMNEDATION

These results document the feasibility of implementing a health education program on menstrual hygiene in secondary schools serving rural Bangladesh. The program produced significant

positive changes in knowledge, beliefs, practices, disorder experiences, and behavior or restrictions regarding menstrual hygiene. More intense or longer interventions may be needed to significantly improve good menstrual hygiene practices in this population. Taking into account the health implications and prevailing socio-cultural and economic factors, there is also an urgent need for intensifying effective strategies to persuade the adolescent school girls to adopt healthy menstrual practices. A well-informed continuous, school education program should be imparted to the students. In addition, the findings emphasize the inclusion of safe hygiene and sanitary practices that should be included in the school curricula as well as greater communication between female students and teachers and between daughters and mothers.

Acknowledgments This research was supported by 'Honjo International Scholarship Foundation', Japan. The authors would like to thank them for their financial contribution to this important study. We also wish to thank all participants, teachers, and education officers who aided in conducting this research. Finally, we must thank Dr. Nowsheen Sharmin Purabi, Register Gyn. and Obst. at Anwer Khan Medical College, Dhaka, Bangladesh for her training and support for the Research Assistants which made it possible to conduct this research.

Contributors EHS and KS develop the proposal and implement the study. KI and MM was involved in the field study. MR and EHS did the analyses and wrote the manuscript. All authors checked and approved the final manuscript.

Funding This study was funded by "Honjo International Scholarship Foundation', Japan.

Competing interests None.

Data sharing statement No additional data are available.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1. World Health Organization. Adolescent friendly health services. An agenda for change. *World Health Organization*. Geneva: 2002.

2. Marianne E, McPherson E, Korfine L. Menstruation across time: menarche, menstrual attitudes, experiences and behaviors. *Women's Health Issues* 2004; 14: 193-200.

3. Aniebue UU, Aniebue PN, Nwankwo TO. The impact of pre-menarcheal training on menstrual practices and hygiene of Nigerian school girls. *Pan Afr Med J* 2009; 2:9.

4. Rokeya A, Kabita Y. Menstrual hygiene: breaking the silence. *Water Aid Bangladesh* 2007; 283-87.

5. Dasgupta A, Sarkar M. Menstrual hygiene: How Hygienic is the Adolescent Girl? *Indian J Comm Med* 2008; 33:77-80.

6. Menstrual Hygiene. Feminine Hygiene, Gynaecology and Menstruation Information, Resources and Pro-sducts for Dads and Husband. http://www.mens-trualhygiene.com

7. Ayalew T, Meseret Y, Yeshigeta G. Reproductive Health Knowledge and Attitude among Adolescents: A community based study in Jimma Town, Southwest Ethiopia. *Ethiop J Health Dev* 2008; 22: 243-251.

8. Suneela G, Nandini S, Ragini S. Socio-cultural Aspects of Menstruation in an Urban Slum in Delhi, India. *Reprod Health Matters* 2001; 9: 16-25.

9. Olayinka OO, Akinyinka OO. Unmet Need for Sexuality Education among Adolescent Girls in Southwest Nigeria: A Qualitative Analysis. *Afr J Reprod Health* 2004; 8: 27-37.

10. Ahuja A, Tiwari S. Awareness about pubertal changes among adolescent girls. *Journal of Family Welfare* 1995; 41: 46-50.

11. Chaudhari RH. Socio-economic demographic and reproductive health profile of adolescents in the SAARC countries. Paper presented in south Asia Conference on Adolescents; 21-23 July 1998; New Delhi, India.

12. Khanna A, Goyal RS, Bhawsar R. Menstrual practices and reproductive problems: A study of adolescent girls in Rajasthan. *Journal of Health Management* 2005; 7: 91-97.

13. Mudey AB, Keshwani N, Mudey GA, et al. A cross-sectional study on the awareness regarding safe and hygienic practices amongst school going adolescent girls in the rural areas of Wardha district. *Global Journal of Health Science* 2010; 2: 225-231.

14. Bhatia JC, Cleland J. Self-reported symptoms of gynecological morbidity and their treatment in south India. *Studies in Family Planning*1995; 26: 491-495.

15. Mehara S. (Ed), Adolescent Girl: An Indian perspective. MAMTA Health Institute for Mother and Child, Saket, New Delhi. 1995: pp. 75-78.

16. Ghattargi CH, Deo DS. Preparation and Practices regarding Menstruation: A comparative study in Rural and Urban Adolescent Girls. *Indian J of Comm Med* 2005; 30: 10-14.

17. Singh AJ. The place of menstruation in the reproductive lives of women of rural north India. *Indian J of Comm Med* 2006; 31:10-14.

18. Kabir B, Barua MK, Ahmed M. Improving menstrual hygiene facilities in secondary schools Initiatives from BRAC-WASH Program. Dhaka, Bangladesh, 31 January -2 February 2012.

19. Ali A, Mahmud SN, Karim A, et al. Knowledge and practice of NFPE-AGG graduates regarding menstruation. Dhaka: Bangladesh Rural Advancement Committee, 1996.

20. Drakshayani Devi K, Venkata Ramaiah P. A study on menstrual hygiene among rural adolescent girls. Indian *J Med Sci* 1994; 48: 139-143.

21. Narayan KA, Srinivasa DK, Pelto PJ, et al. Puberty rituals, reproductive knowledge and health of adolescent school girls in South India. *AP Pop Jour* 2001; 16: 225-238.

22. Bangladesh Bureau of Statistics (BBS), 2007. *BBS Report* 2007. Government of the People's Republic of Bangladesh. http://www.bbs.gov.bd/Home.aspx accessed on 12 June 2013.

23. Lawan UM, Yusuf NW, Musa AB. Menstruation and Menstrual Hygiene amongst Adolescent School Girls in Kano, Northwestern Nigeria. *Afr J of Reprod Health* 2010; 14: 201-207.

24. Anju A, Patil R. Menstrual Hygiene and Practices of Rural Adolescent Girls of Raichur. Int J *Biol Med Res* 2013; 4: 3014- 3017.

25. El-Gilany AH, Badawi K, El-Fedawy S. Menstrual Hygiene among Adolescent School girls in Mansoura, Egypt. *Reprod Health Matters* 2005; 13:147–152.

26. Liu H, Yang F, Li Z, et al. Passive smoking, Cyp1A1 gene polymorphism and dysmenorrhea. *Reprodu Toxicol* 2007; 24: 114-119. DOI: 10.1016/j.reprotox.2007.04.069.

27. Kovacs M. The children's depression inventory. *Psychopharmacology Bulletin* 1985; 21: 995-998.

28. Kovacs M. Children's Depression Inventory. North Tonawanda, NY: Multi-Health Systems, Inc. 1992.

29. Yaacob SN, Mansor RJ, Ikechukwu AT. Loneliness, stress, self-esteem and depression among Malaysian adolescents. *Jurnal Kemanusiaan Bil*.14, Dis 2009.

30. Cohen S, Karmarck T, Mermelstein R. A global measure of perceived stress. J *Health and Social Behavior* 1983: 24: 385-396.

31. Chakraborti A1, Ray P, Sanyal D, et al. Assessing perceived stress in medical personnel: in search of an appropriate scale for the Bengali population. *Indian J Psychol Med* 2013; 35(1):29-3

32. Ayafi SA. Factors associated with health behavior regarding menstruation among Saudi intermediate school girls in Riyadh city. Master thesis, Nursing College, King Saud University 1999.

33. Hassanen H, Tosson M, El-Elkareem EA. Effect of health education and training program for secondary school students on menstruation at Assiut Governorate. *Bulletin of High Institute of Public Health* 2004; 34: 575-94.

34. Afzali M, Allameh R. Study of educational needs of 12-14 years old girls about adolescent health and determines appropriate and effective strategies for adolescent health education. *Koomesh* 2000; 1:39-47.

35. Eswi A, Helal H, Elarousy W. Menstrual attitude and knowledge among Egyptian female adolescents. *J of Am Sci* 2012; 8: 555-565.

36. Lee K, Chen Y, Lee K, et al. Menstruation among adolescent girls in Malaysia: a cross-sectional school survey. *Singapore Medical Journal* 2006; 47: 869-874.

37. Warren MP, Rebecca JL. What is the effect of exercise on primary dysmenorrheal? Products and prostaglandins as a root of menstruation WJSM, 1999; 33: 227.

Table 1: Socio-demographic characteristics of the participants (n=416)

Characteristic	Number (n)	Percentage (%)
Age, years		
11-12	64	15.4
13	154	37.0
14+	198	47.6
Religion		
Muslim	394	94.7
Non-Muslim	22	5.3
Father's education		
No education	57	13.7
Incomplete primary	176	42.3
Complete primary	94	22.6
Secondary or higher	89	21.4
Mother's education		
No education	49	11.8
Incomplete primary	173	41.6
Complete primary	119	28.6
Secondary or higher	75	18.0
Household size		
2-4	116	27.9
5	126	30.3
6+	174	41.8
House type		
Pacca	71	17.1
Half-pacca	60	14.4
Kancha	285	68.5
Wealth Index[a]		
Poor	116	27.9
Middle	144	34.6
Rich	156	37.5

[a]Constructed from data on household assets, including ownership of durable goods (such as televisions and bicycles) and dwelling characteristics (such as source of drinking water, sanitation facilities, and construction. We used principal components analyses to assign individual household wealth scores.

Pacca means brick-built; *Half-pacca* means only floor is brick-built and no brick in the roof; *Kancha* means no brick in the house.

Table 2: Impact of menstrual educational program on correct menstruation knowledge and beliefs (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Duration of normal menstruation cycle	322	77.4	389	93.5	16.1	**0.002**
Poor menstruation hygiene predispose to infection	284	68.3	398	95.7	27.4	**<0.001**
Hygiene can prevent menstrual pain	279	67.1	391	94.0	26.9	**<0.001**
Menstruation blood is impure	279	67.1	399	95.9	28.8	**<0.001**
Proper sanitary products should use for menstruation protection	241	57.9	339	81.5	23.6	**<0.001**
Cause of menstruation	334	80.3	353	84.8	4.5	0.886
Origin of menstruation blood	41	9.9	55	13.2	3.3	0.687
Age of normal cessation of menstruation	245	58.9	352	84.6	25.7	**<0.001**
Influence of hot or cold food on menses	273	65.6	358	86.1	20.5	**0.001**
As an assured fertility (fecundity)	179	43.0	190	45.7	2.7	0.556
Knowledge and beliefs grading						
Poor (0-3)	120	28.8	7	1.7	-27.1	**<0.001**
Medium (4-7)	84	20.2	66	15.9	-4.3	
High (8-10)	212	51.0	343	82.4	31.4	

We categorized as poor knowledge (0-3 pints), medium (4-7 points), and high (8-10).

Table 3: Impact of menstrual educational program on menstrual hygienic practices by adolescent girls (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Absorbent used during menstruation						
Sanitary pad	70	16.8	163	39.2	22.4	**0.003**
New cloths	207	49.8	209	50.2	0.4	
Old cloths/others	139	33.4	44	10.6	-22.8	
Frequency of changing pad/cloths per day						
4+ times	35	8.4	321	77.2	68.8	**<0.001**
2-3 times	322	77.4	93	22.4	-55.0	
1 time	59	14.2	2	0.5	-13.7	
Drying of used absorbent						
Outside room with sunlight	78	18.8	401	96.4	77.6	**<0.001**
Inside room with sunlight	46	11.1	5	1.2	-9.9	
Inside/outside room without sunlight	292	70.1	10	2.4	-67.7	
Storing of washed clothes						
Clean and covered place[a]	159	38.2	170	40.8	2.6	0.077
Clean and open space[b]	104	25.0	85	20.4	-4.6	
Unclean and open/covered place[c]	153	36.8	129	31.0	-5.8	
Methods of displace/dispose						
Buried/burn/dustbin	235	56.5	341	82.0	25.5	**0.004**
Latrine	65	15.6	49	11.8	-3.8	
Throw on the roads	116	27.9	26	6.2	-21.7	
Cleaning of genitalia						
Every time during toilet use	65	15.6	145	34.8	19.2	**0.005**
During bathing	202	48.6	254	61.1	12.5	
Do not clean	149	35.8	17	4.1	-31.7	
Material used for cleaning of External genitalia						
Water and antiseptic	30	7.2	45	10.8	3.6	0.448
Soap and Water	199	47.8	191	45.9	-1.9	
Only water/not cleaning	187	45.0	180	43.2	-1.8	
Practice grading						
Poor (0-4)	60	14.4	3	0.7	-13.7	**0.012**
Fair (5-8)	236	56.8	43	10.3	-46.5	
Good (9+)	120	28.8	370	88.9	60.1	

[a]Suitcase, box, cupboard, and shopper; [b]Store room, anywhere in the room, under cushion, under the bed, behind the door, within the washroom; [c]Gallery, under the kitchen roof, anywhere in the room, under cushion, under the bed, behind the door, within the washroom.

Table 4: Impact of menstrual educational program on menstrual disordered experienced, behaviors and restrictions (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Menstrual disorders experienced						
Regularity of menstruation	393	94.5	414	99.5	5.0	**0.023**
Complications during menstruation	327	78.6	248	59.6	-19.0	**0.002**
Types of complications during menstruation						
Physiological symptoms						
Excessive bleeding	44	10.6	13	3.1	-7.5	**<0.001**
Headache	32	7.7	28	6.7	-1.0	0.789
Increase appetite	26	6.2	18	4.3	-1.9	0.297
Greasy skin	28	6.7	6	1.4	-5.3	**0.002**
Dysmenorrhea						
Pain in abdominal/groin/ lumber region	256	61.5	219	52.6	-8.9	**0.012**
Psychological symptoms	35	8.4	13	3.1	-5.3	**0.025**
Discomfort	22	5.3	3	0.7	-4.6	**0.032**
High stress©	16	3.8	6	1.4	-2.4	0.052
Irritability	18	4.3	3	0.7	-3.6	**0.044**
Depression*						
Consult with someone for menstruation related complications	378	90.8	415	99.8	9.0	**0.003**
Behaviors and restrictions						
Visit relatives, friends, and neighbors during menses						
No	189	45.4	110	26.4	-19.0	**0.002**
Yes	227	54.6	306	73.6	19.0	
Doing household activities during menses						
No	94	22.6	85	20.4	-2.2	0.438
Yes	322	77.4	331	79.6	2.2	
Attending school						
No	32	7.7	11	2.6	-5.1	**0.019**
Yes	384	92.3	405	97.4	5.1	

*A cut-off score ≥ 20 as depressed. ©A cut-off score of greater than median ≥ 20 was consider as high stress mood.

Figure 1: Selection of sample.

Effect of school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh

Syed Emdadul Haque,[1, 6*] Mosiur Rahman,[2] Kawashima Itsuko,[3] Mahmuda Mutahara,[4] Kayako Sakisaka [5]

[1]UChicago Research Bangladesh, Dhaka, Bangladesh

[2]International Health and Medicine, Division of Public Health, Graduate School of Medicine, Tokyo Medical and Dental University, Tokyo, Japan

[3]Honjo International Scholarship Foundation, 1-14-9 Tomigaya, Tokyo 151-0063, Japan

[4]Wageningen University, Netherlands

[5]Faculty of Policy Studies, Chuo University, Japan

[6]United Nations University-International Institute for Global Health (UNU-IIGH), Malaysia

***Correspondence author:**
Dr Syed Emdadul Haque
UChicago Research Bangladesh
House #4, Road #2/B, Sector #4, Uttra-1230
Dhaka, Bangladesh
Email address: emdad91@gmail.com; emadad@urb-bd.org; syed.emdadul@unu.edu

ABSTRACT

Objectives: To assess the impact of a school-based menstrual education program on (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) restrictions and behaviors practiced.

Design: Intervention study.

Setting: Araihazar area in Bangladesh.

Participants: 416 adolescent female students (grades 6-8) and aged between 11-16 years old living with their parents.

Interventions: This school-based health education study was conducted during April 2012 to April 2013.

Primary and secondary outcome measure: Out of 26 high schools in the study area, we randomly selected 3 schools. We delivered six months of educational intervention by trained (TOT by certified OB/GYN) Research Assistants (RAs) on menstrual hygiene among school girls. RAs read the questionnaire and participants answered by them. The changes in knowledge, beliefs, practices, menstrual disorders experienced, and restrictions and behaviors practiced toward menstrual hygiene were compared between the baseline and the follow-up.

Results: Significant improvement (P<0.001) was observed regarding high knowledge and beliefs scores at the follow-up compared with the baseline (51% versus 82.4%). Significant improvement was also observed in overall good menstrual practices (28.8% versus 88.9%) including improvement in using sanitary pads (22.4%), frequency of changing pad/cloths per day (68.8%), drying absorbent (77.6%), methods of disposing the absorbent (25.5%), and cleaning of genitalia (19.2%). During the follow-up, we observed a significant difference in improving participants' regularity of menstrual cycle (94.5% versus 99.5%) and lowering the experiences of complications during menstruation (78.6% versus 59.6%).

Conclusions: The program produced significant changes in the knowledge, beliefs, practices, complications, and behavior or restrictions regarding menstrual hygiene. These results document the feasibility of implementing a health education program for adolescents on menstrual hygiene in secondary schools serving rural Bangladesh.

Keywords: School-based health education; menstrual hygiene; adolescent girls; Bangladesh.

Strengths and limitations of this study

- This is the first evaluation study of menstrual educational program among adolescent school girls in Bangladesh.
- This study evaluated menstrual knowledge, beliefs, and practices of the students of grade 6-8 in Bangladesh. We also evaluated menstrual disorders experienced by the adolescents.
- The educational program showed significant increases on knowledge (51% to 82.4%), belief, and practices (28.8% to 88.9%).
- Significant improvements were also observed with regards to the restrictions on visits to relatives, friends, and attending school during the menstruation.
- The same educational program should implement for all adolescent girls in Bangladesh.

INTRODUCTION

Adolescence is a period of rapid transition in life from girlhood to womanhood. The onset of menstruation is one of the most important changes that occur for girls during the adolescent years.[1] The first menstruation (menarche) occurs between the ages of 11 and 15. [2-3] Poor menstrual hygiene and inadequate self-care are major determinants of morbidity and other complications among this age group such as urinary tract infections, scabies in the vaginal area, abnormal abdominal pain, complications during pregnancy, and absence from schools. [4-7] On the other hand, many parts of developing countries a culture of silence surrounds the topic of menstruation and related issues. [8-9] As a result, many young girls lack appropriate and sufficient information regarding menstrual hygiene. Infections due to lack of hygiene during menstruation have been reported in many studies. [10-15] They also revealed that most adolescent girls had incomplete and inaccurate information about menstrual physiology and hygiene. The menstrual information they did have was acquired primarily through mothers, television, friends, teachers, and relatives. [5, 16-17]

Menstruation is still regarded as something unclean or dirty in Bangladeshi society. [4] Because of various myths, misconceptions, and restrictions practiced during menstruation, adolescent girls in Bangladesh often develop negative attitudes towards this natural physiological phenomenon. The majority of girls lack scientific knowledge about menstruation and puberty. [18] Adolescent girls in Bangladesh are often reluctant to discuss this topic with their parents and hesitant to seek help regarding their menstrual problems. Most girls are not informed about menarche or how to manage menstrual bleeding. [18] Studies in rural Bangladesh and India found that 69.0% of adolescent girls were using old pieces of cloth or even no protection at all during menstruation. [19-20] Therefore, the need to create awareness and increase access to the requisite

sanitary infrastructure related to menstrual hygiene is important for school-aged adolescents in Bangladesh.

Learning menstrual hygiene is a vital part of health education for adolescent' girls so they can carry on regular work/habits throughout their adult life. [21] The ideal menstrual health education curriculum would encourage students to think about the relationships between knowledge, choice, behaviors, and enhanced human health. However, despite the apparent need to achieve several millennium development goals (MDGs), to our knowledge no study has been conducted on menstrual hygiene educational intervention among school girls in Bangladesh. Therefore, the present study was designed to evaluate the effectiveness of a school-based menstrual educational program regarding (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) the restrictions and behaviors practices by 6-8 grade school girls in Bangladesh.

METHODS

Study design and participants

This intervention study was conducted in Araihazar Thana, located at the Narayanganj District in Bangladesh. Araihazar Thana is located 25 km south-east of the capital, Dhaka. The total area of this Thana is 183.35 km² with 63,080 household units and a population of 331,556. Males constitute 51.7% of the population, and females 48.3%. Araihazar has an average literacy rate of 53.0% (7+ years of formal education), compared to the national average of 68.4%. [22]

Out of 26 high schools (grade 6-10) in the study area, we randomly selected three schools for this study. From these three schools, one was girls-only and the other two were co-educational. The socioeconomics, cultural norms, religions, and geographical locations of these schools were

very similar to each other but not adjacent. In those three schools, 597 school aged girls were adolescence. Out of 597, 438 were willing to join in the study. However, 22 school aged girl did not reach the age at menarche. Therefore, the final participants were 416 (Figure 1). Participants were selected using the following criteria: (1) they were within grades 6-8, (2) not critically ill, and (3) had achieved menarche. Participants aged were between 11-16 years old and they were living with their parents.

Data collection procedure

Before conducting each interview, SEH, the principal investigator of this study, visited all three schools and received permission to conduct the survey and to provide health education to adolescent girls of the corresponding schools. After the permission, we conducted a pilot survey of the questionnaire and revised as suggested for the final survey. The questionnaires were drafted in English and then translated into Bangla, the national language of Bangladesh. Back-translation from Bangla to English was done before and after the pretest questionnaires were tested, as a validation exercise. We also modified the questionnaire based on the results of the pre-test to make it more understandable and easier for participants to answer. The baseline survey was conducted in April 2012. Trained RAs read loudly the questions and the answer was given by the participants.

After completion of the baseline survey, we hired one supervisor, a local Obstetrician and Gynecologist, and 3 research assistants (RAs) with good knowledge of the study's target population. Prior to the survey, we gave 4-days training to RAs and one female school teacher (selected from the corresponding schools) on adolescent health education focusing on menstrual hygiene and on the importance of maintaining the confidentiality of the participants'

information. The training was done using a field manual which we developed in the Bangla language. Menstrual education focused on knowledge, beliefs, behaviors, and restrictions on menstrual hygiene and also on menstrual disorders among the adolescent girls. The education materials were developed by our employed OB/GYN and ensured culturally acceptable for the girls. Twelve 45-minute lessons were delivered by the RAs once every 15 days. Female RAs were recruited for the study, so that adolescent girls would feel comfortable discussing these issues. Furthermore, 12 Focus Group Discussions (FGDs) were conducted in the schools so that RAs and adolescent girls could become well acquainted with each other, as this is a very sensitive topic to discuss in Bangladesh. In addition, FGDs were conducted in order to evaluate the effectiveness of the intervention using a qualitative approach. After six months of intervention, follow-up data collection was carried out in the schools using the same questionnaire as used in the baseline regarding knowledge, beliefs, practices, types of complications, and restrictions on menstrual hygiene. RAs visited the students' houses who were not available at school during the follow-up data collection.

This study protocol was reviewed and approved by the ethical committee of Bangladesh Medical Research Council (BMRC). Prior to conducting the baseline survey, participants were informed about the study, invited to participate, and informed of their right to decline. Written consent was obtained from the parents and verbal consent was obtained from the Head teacher, class teacher, and participants. In addition, we obtained written permission for this study from the local Education Officer under the Ministry of Education (MoE) in Bangladesh.

Measures

Intervention components

Knowledge and beliefs about menstruation

This section of the questionnaire consisted of 10 multiple choice questions to determine pupils' knowledge regarding (1) normal monthly duration of menstruation, (2) poor menstrual hygiene predisposing infection, (3) hygienic practices preventing menstrual pain, (4) menstrual blood being considered impure, (5) proper sanitary products, (6) cause of menstruation, (7) origin of menstrual blood, (8) age of normal cessation of menstruation, (9) hot or cold food affecting menstrual cycle, and (10) menstruation as an assurance of fertility (fecundity).

The students' knowledge and beliefs were scored using a system adopted from previous studies. [23-25] Each correct response was awarded one point, whereas any incorrect or "don't know" answers attained no mark. This gave a total possible score of 10 points. Respondents that scored 0-3 points were adjudged as having poor knowledge, those with 4-7 points, medium knowledge, and those with 8-10 points were considered to have high knowledge. The *Cronbach* α was 0.73 for knowledge and beliefs instrument.

Practices related to menstrual hygiene

This section of the questionnaire consisted of seven items assessing girls' practices of menstrual hygiene: (1) absorbent used during menstruation, (2) frequency of changing out absorbent per day, (3) drying of used absorbent, (4) storing of washed clothes, (5) methods of displace/disposal of the used absorbent, (6) cleaning of external genitalia, and (7) material used for cleaning of external genitalia. A score of 2 was given for good hygienic practices, a score of 1 was given for fair practices, and a score of 0 was given for poor practices. The maximum score was ranged

from 0-14 points. Students that scored 0-4 points, 5-8 points, and 9+ points under practice were adjudged as having poor, fair, and good practices respectively. The *Cronbach* α was 0.82 for practice instrument.

Menstrual disorders experienced and menstrual behaviors/restrictions

Regarding menstrual disorders experienced by the adolescent, the following items were evaluated: (1) regularity of menstrual cycle, (2) types of complications experienced during menstruation, and (3) consultation with someone for menstrual-related complications. Moreover, this section also consisted of items to assess girls' behaviors and restrictions during menstruation: (1) visits to holy places, (2) visits to relatives, friends, and neighbors, (3) participation in household activities, and (4) school attendance during menses. Dysmenorrhea was considered as pain in the abdominal, groin and lumbar regions on the day before or on the first day of menstruation. [26] We also assessed adolescent depression using Children Depression Inventory (CDI). [27] The CDI consists of feelings and ideas grouped into 27 items. The scale scores range from 0 to 54. The *Cronbach α* was 0 .73 for this study. We followed a cut-off score ≥ 20 as depressed. [28-29]

Stress was measured using validated Perceived Stress Scale-10 (PSS). [30-31] The PSS scale scores range was from 0 to 40 with high score represents high social stress. The *Cronbach α* was 0.75. A cut-off score of greater than the median ≥ 20 was considered as high stress mood. [29]

Statistical analysis

Data were cross-checked for consistency before final data entry, using Microsoft Excel**.** All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 18

(SPSS Inc., Chicago, IL, USA). Descriptive analyses were conducted to estimate socio-demographic characteristics of the respondents. We used McNemar's Chi-square analyses as because the same individuals are measured (before and after the survey) twice to evaluate the impact of an education program on four recurrent themes of menstruation: (i) knowledge and beliefs; (ii) menstrual disorders experienced; (iii) hygiene practices; and (iv) menstruation behavior and restrictions of the school-aged adolescent girls between the baseline and the follow-up period. In all analyses, the level of significance was set at $P<0.05$ (two-tailed).

RESULTS

More than half of the respondents (52.4%) were 11 to 13 years old, 13.7%, and 11.8% of the girls' parents had no education (Table 1). Approximately 95% were Muslim and 41.8% had a household of six or more. Out of 416 participants, 27.9% were defined as being poor, 34.6% belonged to middle bands of wealth, and 37.5% were defined as being rich. Regarding their house type, 17.1% were lived in *pacca*, 14.4% in *half-pacca*, and 68.5% in *kancha house* (Table 1).

In the pre-test stage, 77.4%, 68.3%, and 67.1% of girls had knowledge regarding the duration of a normal average menstrual cycle (between 21 to 35 days), that poor menstruation can predispose infection, and that hygienic practices during menstruation period can prevent menstrual pain. In the follow-up period, significant increases ($P<0.001$) were observed in the level of knowledge of these three indicators (93.5%, 95.7%, and 94%). Significant improvement was observed regarding the knowledge that menstrual blood is not impure (67.1% vs 95.9%) and that proper sanitary products should be used for menstrual protection (57.9% vs 81.5%) at the follow up period. There was no statistically significant difference between the baseline and the

follow-up period regarding respondents' correct knowledge on the cause of menstruation, origin of menstrual blood, or that menstruation was an assurance of fertility. However, significant differences were also observed concerning the respondents correct knowledge about age of normal cessation of menstruation and that there is no influence of hot and cold foods on menstrual cycle. Overall, significant improvement (P<0.001) was observed regarding high knowledge and beliefs scores at the follow-up period compared with the baseline (51% vs 82.4%; Table 2).

With regards to absorbent used during menstruation, significant improvement was observed (P<0.001) in using sanitary pads during menstruation in the follow-up period (39.2%) compared with the baseline (16.8%; Table 4). Frequency of changing pad/cloths per day and drying absorbent outside the room with sunlight was higher in the follow-up period compared with the baseline. No significant differences were observed in storing of washed clothes between the baseline and the follow-up period. Methods of disposing the absorbent through burial/burning or through dustbin were significantly higher at the follow-up period compared with the baseline. Significant improvement was observed at the follow-up period in cleaning of genitalia every time the toilet was used or during bathing. It was higher at the follow-up period than at the baseline (Table 3). In addition, no significant differences were observed in material used to clean external genitalia between the baseline and the follow-up period. Regarding the practices grading score, significant improvement (88.9% vs 28.8%) was observed in good practices in the follow-up period compared with the baseline.

A significant difference was observed between the baseline and the follow-up in improving participants' regularity of menstrual cycle (94.5% vs 99.5%) and lowering the experiences of complications during menstruation (78.6% vs 59.6%; Table 3). For the physiological symptoms,

a significantly lower number of adolescents experienced excessive bleeding and greasy skin at the follow-up period compared with the baseline. Regarding dysmenorrheal complexity, significantly lower numbers of adolescents reported experiencing abdominal pain and nausea and or vomiting at the follow-up period. With regard to psychological symptoms, significant differences were observed in experiencing discomfort, stress, and depression between baseline and follow-up period. At the follow-up period, respondents were significantly more likely to consult someone for menstrual related complications than at the baseline (99.8% vs 90.8%; Table 4). During the baseline survey, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% of girls reported that they did not attend school during menstruation (Table 4). In the follow-up period, significant improvements were observed with regard to restrictions followed by them. No significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses.

DISCUSSION

To the best of our knowledge, this is the first study to evaluate school-based menstrual educational intervention on knowledge, beliefs, and practices of school-aged adolescent girls in Bangladesh. The present study demonstrates that the knowledge and beliefs regarding menstrual hygiene was low before the implementation of the program. After implementation of the program, there was a significant increase in knowledge among the adolescents, from 51% to 82.4%. This finding coincides with those of other studies in Saudi Arabia and Egypt which revealed the same results. [32-33]

Hygiene related practices during menstruation are of considerable importance as it affects health by increasing vulnerability to infection especially infections of the urinary tract and

perineum. [4] Poor menstrual hygiene management also effects on reproductive tract infection (RTI). In this study, only 22.4% of girls are using pad even after the health education. The rest are using poor quality cloths. The cloths are colored using toxic elements which might make them to uterine pain. On the other hand, they dry the cloths inside the room which might effects also. Good hygiene, such as the use of sanitary pads and adequate washing of genital area, is essential during menstruation. [4-6] Girls of reproductive age need access to clean and soft absorbent sanitary products, which in the long run protects their health. In the present study, during the pre-intervention phase, only 28.8% of adolescents had good hygiene practices. In the post-intervention phase, there was a significant improvement in good menstrual practices (60.1%). Various studies have shown that health education increases knowledge and positive attitudes towards puberty as a natural physiological phenomenon. [34]

Regarding menstrual disorders among adolescent girls, in the pre-intervention phase 10.6% and 6.7% of adolescents suffered from excessive bleeding and greasy skin. After implementation of the health education program, there was a significant reduction observed regarding such disorders. Dysmenorrhoea is a very common problem among adolescent girls; it affects their quality of life. In the pre-intervention phase 61.5% and 4.6% of adolescents suffered from abdominal pain, nausea, and vomiting; this result is similar to the study done in Egypt. [33, 35] In addition to that, dysmenorrhea (pain during menses) was reported by almost all students in this study, in which 59.8% of them had severe pain followed by back ache and fatigue. This result matched with a study done among Malaysian school girls in 2009. [36] The use of oral contraceptives and hot drinking water may suppress ovulation and reduce menstrual fluid prostaglandin (PG) activity levels which are responsible for the occurrence of dysmenorrheal. Moreover, regular exercise can induce amenorrhea and it may decrease symptoms of

dysmeorhhoea. [37] Regarding psychological symptoms, discomfort and stress rate also changed significantly at the follow up period. At the follow-up period, they were more likely to consult someone about menstrual related complications than at the baseline (99.8% vs 90.8%).

During the pre-intervention phase, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% girls reported that they did not attend school during menstruation. In the follow-up, significant improvements were observed with regard to the restrictions followed by them. However, no significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses. These findings therefore illustrate that, there are still greater influences of socio-cultural beliefs and taboos regarding menstruation. Different types of restrictions practiced during menstruation were also reported by one Indian study [5] where girls do not perform any household work during the menses.

This intervention study provides several important findings and insights for adolescent girls. However, the study had several limitations. First, findings of this study were based on self-reported outcomes and may therefore differ from actual behavior. Adolescents may have over-reported their use of good menstrual hygiene practices in order to satisfy the interviewer. However, all the participants joined the health education session regularly. Second, information about the complications was obtained from the participants, and not from medical records due to time and budget limits, therefore, bias could have occurred that may have affected the reliability of the data. However, our trained RAs received training from physicians in order to collect such information in a reliable manner. Third, although adolescents, who experienced pain in the abdominal, groin and lumbar regions on the day before or on the first day of menstruation, were considered as dysmenorrhea in this study, however, we could assess the degree of pain by

utilizing scale. In future we will certainly consider this point. Fourth, this study concluded that education regarding menses has a beneficial impact for the young women in improving normal menstrual cycle. However, it may be possible that, within the passage of time in this young age group would allow more girls to achieve ovulatory and hence regular cycles - so it may be possible that time may help to done this, not the education. A control group of girls of a similar age would be helpful to answer the questionnaire. Fifth, we claimed that improper menstrual hygiene can increase the risk of UTI. However, there is no data to say that UTIs are increased due to external hygiene issues. One cause might be that the used cloths mostly are colored and contains toxic elements which might make them to uterine pain.

Finally, although all possible efforts were made to standardize the educational intervention, it is possible that other environmental factors such as differences in the abilities of RAs and their ability to disseminate study messages could affect the study outcome. Despite such limitations, the results of the present study provide important findings for policy makers to make rational decisions on improving adolescent reproductive health in Bangladesh.

CONCLUSIONS AND RECOMMNEDATION

These results document the feasibility of implementing a health education program on menstrual hygiene in secondary schools serving rural Bangladesh. The program produced significant positive changes in knowledge, beliefs, practices, disorder experiences, and behavior or restrictions regarding menstrual hygiene. More intense or longer interventions may be needed to significantly improve good menstrual hygiene practices in this population. Taking into account the health implications and prevailing socio-cultural and economic factors, there is also an urgent need for intensifying effective strategies to persuade the adolescent school girls to adopt healthy

menstrual practices. A well-informed continuous, school education program should be imparted to the students. In addition, the findings emphasize the inclusion of safe hygiene and sanitary practices that should be included in the school curricula as well as greater communication between female students and teachers and between daughters and mothers.

Acknowledgments This research was supported by 'Honjo International Scholarship Foundation', Japan. The authors would like to thank them for their financial contribution to this important study. We also wish to thank all participants, teachers, and education officers who aided in conducting this research. Finally, we must thank Dr. Nowsheen Sharmin Purabi, Register Gyn. and Obst. at Anwer Khan Medical College, Dhaka, Bangladesh for her training and support for the Research Assistants which made it possible to conduct this research.

Contributors EHS and KS develop the proposal and implement the study. KI and MM was involved in the field study. MR and EHS did the analyses and wrote the manuscript. All authors checked and approved the final manuscript.

Funding This study was funded by "Honjo International Scholarship Foundation', Japan.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

REFERENCES

1. World Health Organization. Adolescent friendly health services. An agenda for change. *World Health Organization*. Geneva: 2002.

2. Marianne E, McPherson E, Korfine L. Menstruation across time: menarche, menstrual attitudes, experiences and behaviors. *Women's Health Issues* 2004; 14: 193-200.

3. Aniebue UU, Aniebue PN, Nwankwo TO. The impact of pre-menarcheal training on menstrual practices and hygiene of Nigerian school girls. *Pan Afr Med J* 2009; 2:9.

4. Rokeya A, Kabita Y. Menstrual hygiene: breaking the silence. *Water Aid Bangladesh* 2007; 283-87.

5. Dasgupta A, Sarkar M. Menstrual hygiene: How Hygienic is the Adolescent Girl? *Indian J Comm Med* 2008; 33:77-80.

6. Menstrual Hygiene. Feminine Hygiene, Gynaecology and Menstruation Information, Resources and Pro-sducts for Dads and Husband. http://www.mens-trualhygiene.com

7. Ayalew T, Meseret Y, Yeshigeta G. Reproductive Health Knowledge and Attitude among Adolescents: A community based study in Jimma Town, Southwest Ethiopia. *Ethiop J Health Dev* 2008; 22: 243-251.

8. Suneela G, Nandini S, Ragini S. Socio-cultural Aspects of Menstruation in an Urban Slum in Delhi, India. *Reprod Health Matters* 2001; 9: 16-25.

9. Olayinka OO, Akinyinka OO. Unmet Need for Sexuality Education among Adolescent Girls in Southwest Nigeria: A Qualitative Analysis. *Afr J Reprod Health* 2004; 8: 27-37.

10. Ahuja A, Tiwari S. Awareness about pubertal changes among adolescent girls. *Journal of Family Welfare* 1995; 41: 46-50.

11. Chaudhari RH. Socio-economic demographic and reproductive health profile of adolescents in the SAARC countries. Paper presented in south Asia Conference on Adolescents; 21-23 July 1998; New Delhi, India.

12. Khanna A, Goyal RS, Bhawsar R. Menstrual practices and reproductive problems: A study of adolescent girls in Rajasthan. *Journal of Health Management* 2005; 7: 91-97.

13. Mudey AB, Keshwani N, Mudey GA, et al. A cross-sectional study on the awareness regarding safe and hygienic practices amongst school going adolescent girls in the rural areas of Wardha district. *Global Journal of Health Science* 2010; 2: 225-231.

14. Bhatia JC, Cleland J. Self-reported symptoms of gynecological morbidity and their treatment in south India. *Studies in Family Planning*1995; 26: 491-495.

15. Mehara S. (Ed), Adolescent Girl: An Indian perspective. MAMTA Health Institute for Mother and Child, Saket, New Delhi. 1995: pp. 75-78.

16. Ghattargi CH, Deo DS. Preparation and Practices regarding Menstruation: A comparative study in Rural and Urban Adolescent Girls. *Indian J of Comm Med* 2005; 30: 10-14.

17. Singh AJ. The place of menstruation in the reproductive lives of women of rural north India. *Indian J of Comm Med* 2006; 31:10-14.

18. Kabir B, Barua MK, Ahmed M. Improving menstrual hygiene facilities in secondary schools Initiatives from BRAC-WASH Program. Dhaka, Bangladesh, 31 January -2 February 2012.

19. Ali A, Mahmud SN, Karim A, et al. Knowledge and practice of NFPE-AGG graduates regarding menstruation. Dhaka: Bangladesh Rural Advancement Committee, 1996.

20. Drakshayani Devi K, Venkata Ramaiah P. A study on menstrual hygiene among rural adolescent girls. Indian *J Med Sci* 1994; 48: 139-143.

21. Narayan KA, Srinivasa DK, Pelto PJ, et al. Puberty rituals, reproductive knowledge and health of adolescent school girls in South India. *AP Pop Jour* 2001; 16: 225-238.

22. Bangladesh Bureau of Statistics (BBS), 2007. *BBS Report* 2007. Government of the People's Republic of Bangladesh. http://www.bbs.gov.bd/Home.aspx accessed on 12 June 2013.

23. Lawan UM, Yusuf NW, Musa AB. Menstruation and Menstrual Hygiene amongst Adolescent School Girls in Kano, Northwestern Nigeria. *Afr J of Reprod Health* 2010; 14: 201-207.

24. Anju A, Patil R. Menstrual Hygiene and Practices of Rural Adolescent Girls of Raichur. Int J *Biol Med Res* 2013; 4: 3014- 3017.

25. El-Gilany AH, Badawi K, El-Fedawy S. Menstrual Hygiene among Adolescent School girls in Mansoura, Egypt. *Reprod Health Matters* 2005; 13:147–152.

26. Liu H, Yang F, Li Z, et al. Passive smoking, Cyp1A1 gene polymorphism and dysmenorrhea. *Reprodu Toxicol* 2007; 24: 114-119. DOI: 10.1016/j.reprotox.2007.04.069.

27. Kovacs M. The children's depression inventory. *Psychopharmacology Bulletin* 1985; 21: 995-998.

28. Kovacs M. Children's Depression Inventory. North Tonawanda, NY: Multi-Health Systems, Inc. 1992.

29. Yaacob SN, Mansor RJ, Ikechukwu AT. Loneliness, stress, self-esteem and depression among Malaysian adolescents. *Jurnal Kemanusiaan Bil*.14, Dis 2009.

30. Cohen S, Karmarck T, Mermelstein R. A global measure of perceived stress. J *Health and Social Behavior* 1983: 24: 385-396.

31. Chakraborti A1, Ray P, Sanyal D, et al. Assessing perceived stress in medical personnel: in search of an appropriate scale for the Bengali population. *Indian J Psychol Med* 2013; 35(1):29-33.

32. Ayafi SA. Factors associated with health behavior regarding menstruation among Saudi intermediate school girls in Riyadh city. Master thesis, Nursing College, King Saud University 1999.

33. Hassanen H, Tosson M, El-Elkareem EA. Effect of health education and training program for secondary school students on menstruation at Assiut Governorate. *Bulletin of High Institute of Public Health* 2004; 34: 575-94.

34. Afzali M, Allameh R. Study of educational needs of 12-14 years old girls about adolescent health and determines appropriate and effective strategies for adolescent health education. *Koomesh* 2000; 1:39-47.

35. Eswi A, Helal H, Elarousy W. Menstrual attitude and knowledge among Egyptian female adolescents. *J of Am Sci* 2012; 8: 555-565.

36. Lee K, Chen Y, Lee K, et al. Menstruation among adolescent girls in Malaysia: a cross-sectional school survey. *Singapore Medical Journal* 2006; 47: 869-874.

37. Warren MP, Rebecca JL. What is the effect of exercise on primary dysmenorrheal? Products and prostaglandins as a root of menstruation WJSM, 1999; 33: 227.

Table 1: Socio-demographic characteristics of the participants (n=416)

Characteristic	Number (n)	Percentage (%)
Age, years		
11-12	64	15.4
13	154	37.0
14+	198	47.6
Religion		
Muslim	394	94.7
Non-Muslim	22	5.3
Father's education		
No education	57	13.7
Incomplete primary	176	42.3
Complete primary	94	22.6
Secondary or higher	89	21.4
Mother's education		
No education	49	11.8
Incomplete primary	173	41.6
Complete primary	119	28.6
Secondary or higher	75	18.0
Household size		
2-4	116	27.9
5	126	30.3
6+	174	41.8
House type		
Pacca	71	17.1
Half-pacca	60	14.4
Kancha	285	68.5
Wealth Index[a]		
Poor	116	27.9
Middle	144	34.6
Rich	156	37.5

[a]Constructed from data on household assets, including ownership of durable goods (such as televisions and bicycles) and dwelling characteristics (such as source of drinking water, sanitation facilities, and construction. We used principal components analyses to assign individual household wealth scores.

Pacca means brick-built; *Half-pacca* means only floor is brick-built and no brick in the roof; *Kancha* means no brick in the house.

Table 2: Impact of menstrual educational program on correct menstruation knowledge and beliefs (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Duration of normal menstruation cycle	322	77.4	389	93.5	16.1	**0.002**
Poor menstruation hygiene predispose to infection	284	68.3	398	95.7	27.4	**<0.001**
Hygiene can prevent menstrual pain	279	67.1	391	94.0	26.9	**<0.001**
Menstruation blood is impure	279	67.1	399	95.9	28.8	**<0.001**
Proper sanitary products should use for menstruation protection	241	57.9	339	81.5	23.6	**<0.001**
Cause of menstruation	334	80.3	353	84.8	4.5	0.886
Origin of menstruation blood	41	9.9	55	13.2	3.3	0.687
Age of normal cessation of menstruation	245	58.9	352	84.6	25.7	**<0.001**
Influence of hot or cold food on menses	273	65.6	358	86.1	20.5	**0.001**
As an assured fertility (fecundity)	179	43.0	190	45.7	2.7	0.556
Knowledge and beliefs grading						
Poor (0-3)	120	28.8	7	1.7	-27.1	**<0.001**
Medium (4-7)	84	20.2	66	15.9	-4.3	
High (8-10)	212	51.0	343	82.4	31.4	

We categorized as poor knowledge (0-3 pints), medium (4-7 points), and high (8-10).

Table 3: Impact of menstrual educational program on menstrual hygienic practices by adolescent girls (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Absorbent used during menstruation						
Sanitary pad	70	16.8	163	39.2	22.4	**0.003**
New cloths	207	49.8	209	50.2	0.4	
Old cloths/others	139	33.4	44	10.6	-22.8	
Frequency of changing pad/cloths per day						
4+ times	35	8.4	321	77.2	68.8	**<0.001**
2-3 times	322	77.4	93	22.4	-55.0	
1 time	59	14.2	2	0.5	-13.7	
Drying of used absorbent						
Outside room with sunlight	78	18.8	401	96.4	77.6	**<0.001**
Inside room with sunlight	46	11.1	5	1.2	-9.9	
Inside/outside room without sunlight	292	70.1	10	2.4	-67.7	
Storing of washed clothes						
Clean and covered place[a]	159	38.2	170	40.8	2.6	0.077
Clean and open space[b]	104	25.0	85	20.4	-4.6	
Unclean and open/covered place[c]	153	36.8	129	31.0	-5.8	
Methods of displace/dispose						
Buried/burn/dustbin	235	56.5	341	82.0	25.5	**0.004**
Latrine	65	15.6	49	11.8	-3.8	
Throw on the roads	116	27.9	26	6.2	-21.7	
Cleaning of genitalia						
Every time during toilet use	65	15.6	145	34.8	19.2	**0.005**
During bathing	202	48.6	254	61.1	12.5	
Do not clean	149	35.8	17	4.1	-31.7	
Material used for cleaning of External genitalia						
Water and antiseptic	30	7.2	45	10.8	3.6	0.448
Soap and Water	199	47.8	191	45.9	-1.9	
Only water/not cleaning	187	45.0	180	43.2	-1.8	
Practice grading						
Poor (0-4)	60	14.4	3	0.7	-13.7	**0.012**
Fair (5-8)	236	56.8	43	10.3	-46.5	
Good (9+)	120	28.8	370	88.9	60.1	

[a]Suitcase, box, cupboard, and shopper; [b]Store room, anywhere in the room, under cushion, under the bed, behind the door, within the washroom; [c]Gallery, under the kitchen roof, anywhere in the room, under cushion, under the bed, behind the door, within the washroom.

Table 4: Impact of menstrual educational program on menstrual disordered experienced, behaviors and restrictions (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Menstrual disorders experienced						
Regularity of menstruation	393	94.5	414	99.5	5.0	**0.023**
Complications during menstruation	327	78.6	248	59.6	-19.0	**0.002**
Types of complications during menstruation						
Physiological symptoms						
Excessive bleeding	44	10.6	13	3.1	-7.5	**<0.001**
Headache	32	7.7	28	6.7	-1.0	0.789
Increase appetite	26	6.2	18	4.3	-1.9	0.297
Greasy skin	28	6.7	6	1.4	-5.3	**0.002**
Dysmenorrhea						
Pain in abdominal/groin/ lumber region	256	61.5	219	52.6	-8.9	**0.012**
Psychological symptoms	35	8.4	13	3.1	-5.3	**0.025**
Discomfort	22	5.3	3	0.7	-4.6	**0.032**
High stress©	16	3.8	6	1.4	-2.4	0.052
Irritability	18	4.3	3	0.7	-3.6	**0.044**
Depression*						
Consult with someone for menstruation related complications	378	90.8	415	99.8	9.0	**0.003**
Behaviors and restrictions						
Visit relatives, friends, and neighbors during menses						
No	189	45.4	110	26.4	-19.0	**0.002**
Yes	227	54.6	306	73.6	19.0	
Doing household activities during menses						
No	94	22.6	85	20.4	-2.2	0.438
Yes	322	77.4	331	79.6	2.2	
Attending school						
No	32	7.7	11	2.6	-5.1	**0.019**
Yes	384	92.3	405	97.4	5.1	

*A cut-off score ≥ 20 as depressed. ©A cut-off score of greater than median ≥ 20 was consider as high stress mood.

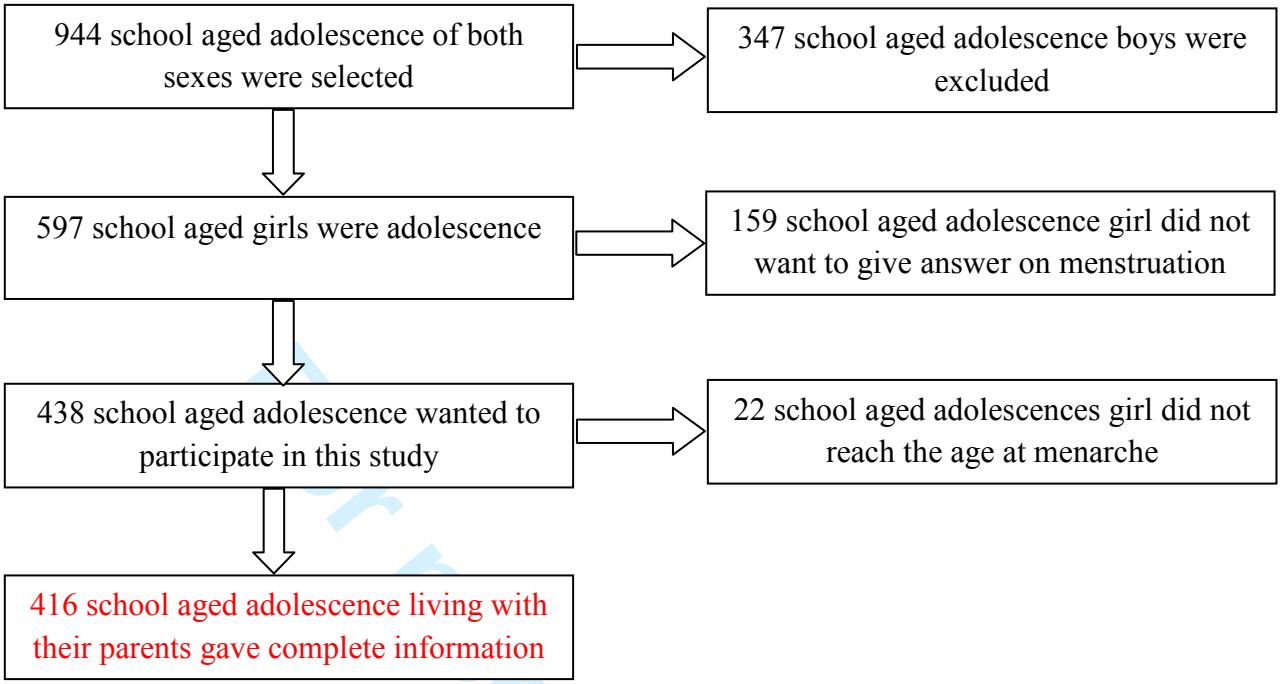
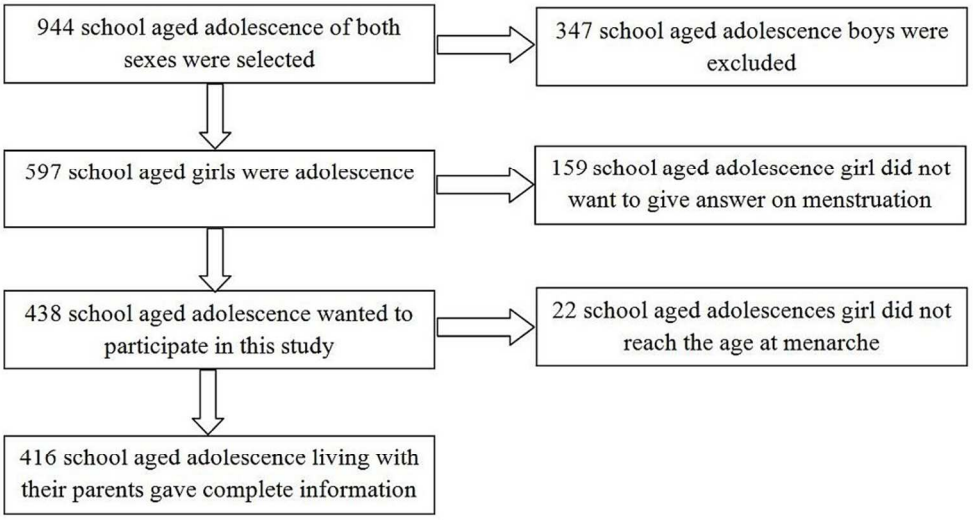


Figure 1: Selection of sample.



90x51mm (300 x 300 DPI)

BMJ Open

Effect of school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2013-004607.R2
Article Type:	Research
Date Submitted by the Author:	29-May-2014
Complete List of Authors:	Haque, Syed; United Nations University-International Institute for Global Health (UNU-IIGH), ; UChicago Research Bangladesh, Rahman, Mosiur; International Health Section, Division of Public Health, Graduate School of Tokyo Medical and Dental University, Itsuko, Kawashima; Honjo International Scholarship Foundation, 1-14-9 Tomigaya, Tokyo 151-0063, Japan, Mutahara, Mahmuda; Wageningen University, Netherlands, Kayako, Sakisaka; Chuo University, Faculty of Policy Studies
Primary Subject Heading:	Public health
Secondary Subject Heading:	Global health
Keywords:	Epidemiology < TROPICAL MEDICINE, EPIDEMIOLOGY, Reproductive medicine < GYNAECOLOGY

Effect of school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh

Syed Emdadul Haque,[1, 6*] Mosiur Rahman,[2] Kawashima Itsuko,[3] Mahmuda Mutahara,[4] Kayako Sakisaka [5]

[1]UChicago Research Bangladesh, Dhaka, Bangladesh

[2]International Health and Medicine, Division of Public Health, Graduate School of Medicine, Tokyo Medical and Dental University, Tokyo, Japan

[3]Honjo International Scholarship Foundation, 1-14-9 Tomigaya, Tokyo 151-0063, Japan

[4]Wageningen University, Netherlands

[5]Faculty of Policy Studies, Chuo University, Japan

[6]United Nations University-International Institute for Global Health (UNU-IIGH), Malaysia

***Correspondence author:**
Dr Syed Emdadul Haque
UChicago Research Bangladesh
House #4, Road #2/B, Sector #4, Uttra-1230
Dhaka, Bangladesh
Email address: emdad91@gmail.com; emadad@urb-bd.org; syed.emdadul@unu.edu

ABSTRACT

Objectives: To assess the impact of a school-based menstrual education program on (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) restrictions on menstruating adolescent.

Design: Intervention study.

Setting: Araihazar area in Bangladesh.

Participants: 416 adolescent female students (grade 6-8) and aged between 11-16 years old living with their parents.

Interventions: This school-based health education study was conducted during April 2012 to April 2013.

Primary and secondary outcome measure: Out of 26 high schools in the study area, we randomly selected 3 schools. We delivered six months of educational intervention by trained (Training of the Trainers (TOT) by certified obstetrics and gynecologist) Research Assistants (RAs) on menstrual hygiene among school girls. RAs read the questionnaire and participants answered by them. The changes in knowledge, beliefs, practices, menstrual disorders experienced, and restrictions and behaviors practiced toward menstrual hygiene were compared between the baseline and the follow-up.

Results: After health education, participants reported to have significant improvement (P<0.001) regarding high knowledge and beliefs scores compared with the baseline (51% versus 82.4%). Significant improvement was also observed in overall good menstrual practices (28.8% versus 88.9%) including improvement in using sanitary pads (22.4%; the changes after the intervention), frequency of changing pad/cloths per day (68.8%), drying absorbent (77.6%), methods of disposing the absorbent (25.5%), and cleaning of genitalia (19.2%). During the follow-up, the participants reported significant improvements on regularity of menstrual cycle (94.5% versus 99.5%) and lowering the experiences of complications during menstruation (78.6% versus 59.6%).

Conclusions: The program produced significant changes in the knowledge, beliefs, practices, complications, and behavior or restrictions regarding menstrual hygiene. These results document the feasibility of implementing a health education program for adolescents on menstrual hygiene in secondary schools serving rural Bangladesh.

Keywords: School-based health education; menstrual hygiene; adolescent girls; Bangladesh.

Strengths and limitations of this study

- This is the first evaluation study of menstrual educational program among adolescent school girls in Bangladesh.
- This study evaluated menstrual knowledge, beliefs, and practices of the students of grade 6-8 in Bangladesh. We also evaluated menstrual disorders experienced by the adolescents.
- The educational program showed significant increases on knowledge (51% to 82.4%), belief, and practices (28.8% to 88.9%).
- Significant improvements were also observed with regards to the restrictions on visits to relatives, friends, and attending school during the menstruation.
- The same educational program should implement for all adolescent girls in Bangladesh.

INTRODUCTION

Adolescence is a period of rapid transition in life from girlhood to womanhood. The onset of menstruation is one of the most important changes that occur for girls during the adolescent years.[1] The first menstruation (menarche) occurs between the ages of 11 and 15. [2-3] Poor menstrual hygiene and inadequate self-care are major determinants of morbidity and other complications among this age group such as urinary tract infections, scabies in the vaginal area, abnormal abdominal pain, complications during pregnancy, and absence from schools. [4-7] On the other hand, many parts of developing countries a culture of silence surrounds the topic of menstruation and related issues. [8-9] As a result, many young girls lack appropriate and sufficient information regarding menstrual hygiene. Infections due to lack of hygiene during menstruation have been reported in many studies. [10-15] They also revealed that most adolescent girls had incomplete and inaccurate information about menstrual physiology and hygiene. The menstrual information they did have was acquired primarily through mothers, television, friends, teachers, and relatives. [5, 16-17]

Menstruation is still regarded as something unclean or dirty in Bangladeshi society. [4] Because of various myths, misconceptions, and restrictions practiced during menstruation, adolescent girls in Bangladesh often develop negative attitudes towards this natural physiological phenomenon. The majority of girls lack scientific knowledge about menstruation and puberty. [18] Adolescent girls in Bangladesh are often reluctant to discuss this topic with their parents and hesitant to seek help regarding their menstrual problems. Most girls are not informed about menarche or how to manage menstrual bleeding. [18] Studies in rural Bangladesh and India found that 69.0% of adolescent girls were using old pieces of cloth or even no protection at all during menstruation. [19-20] Therefore, the need to create awareness and increase access to the requisite

sanitary infrastructure related to menstrual hygiene is important for school-aged adolescents in Bangladesh.

Learning menstrual hygiene is a vital part of health education for adolescent' girls so they can carry on regular work/habits throughout their adult life.[21] The ideal menstrual health education curriculum would encourage students to think about the relationships between knowledge, choice, behaviors, and enhanced human health. It would also help to improve maternal health which can impact on MDG5. However, despite the apparent need to achieve millennium development goals (MDGs), to our knowledge no study has been conducted on menstrual hygiene educational intervention among school girls in Bangladesh. Therefore, the present study was designed to evaluate the effectiveness of a school-based menstrual educational program regarding (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) the restrictions practices by 6-8 grade school girls in Bangladesh.

METHODS

Study design and participants

This intervention study was conducted in Araihazar Thana, located at the Narayanganj District in Bangladesh. Araihazar Thana is located 25 km south-east of the capital, Dhaka. The total area of this Thana is 183.35 km² with 63,080 household units and a population of 331,556. Males constitute 51.7% of the population, and females 48.3%. Araihazar has an average literacy rate of 53.0% (7+ years of formal education), compared to the national average of 68.4%. [22]

Out of 26 high schools (grade 6-10) in the study area, 2 were full government schools and 24 were semi-government schools. From these 2 government schools, we selected one and from 24 semi-government schools, we selected two using simple random sampling method (just draw the

number). We only selected 3 schools due to our time limit and resources. In addition, the possible reasons for choosing these schools are that, they were well-established, older schools, and have easy location. From these three schools, one was girls-only and the other two were co-educational. The socioeconomics, cultural norms, religions, and geographical locations of these schools were very similar to each other but not adjacent (distance between the schools was more than 2 kilometers to another). In those three schools, 597 school aged girls were adolescents. Out of 597, 438 were willing to join in the study. However, 22 school aged girl did not reach the age at menarche. Therefore, the final participants were 416 (Figure 1). Participants were selected using the following criteria: (1) they were within grades 6-8, (2) not critically ill, and (3) had achieved menarche. Participants aged were between 11-16 years old and they were living with their parents.

Data collection procedure

Before conducting each interview, SEH, the principal investigator of this study, visited all three schools and received permission to conduct the survey and to provide health education to adolescent girls of the corresponding schools. After the permission, we conducted a pilot survey of the questionnaire and revised as suggested for the final survey. Using the general guidelines, required for a full study we considered 10% of the sample (n=42) for our pilot test in one of the school in the study area. [23] The questionnaires were drafted in English and then translated into Bangla, the national language of Bangladesh. Back-translation from Bangla to English was done before and after the pretest questionnaires were tested, as a validation exercise. We also modified the questionnaire based on the results of the pre-test to make it more understandable and easier for participants to answer. The baseline survey was conducted in April 2012. Trained RAs read

loudly the questions and the answer was given by the participants. A group of 12-15 students were involved in each survey class room lead by one RA and we requested them not to discuss with the peer about the survey questions. After one session, we invited another group for the survey. The room was provided by the schools.

After completion of the baseline survey, we hired one supervisor, a local Obstetrician and Gynecologist, and 3 research assistants (RAs) with good knowledge of the study's target population. Prior to the survey, we gave 4-days training to RAs and one female school teacher (selected from the corresponding schools) on adolescent health education focusing on menstrual hygiene and on the importance of maintaining the confidentiality of the participants' information. The training was done using a field manual which we developed in the Bangla language. Menstrual education focused on knowledge, beliefs, behaviors, and restrictions on menstrual hygiene and also on menstrual disorders among the adolescent girls. The education materials were developed by our employed OB/GYN and ensured culturally acceptable for the girls. They received menstrual health education by the female RAs and in the same class room where they taught regularly. Males were not allowed to entry there during health education. Twelve 45-minute lessons were delivered by the RAs once every 15 days. The lessons were mostly in verbal but RAs showed the clean cloths, pads, and how to dry and store it. Female RAs were recruited for the study, so that adolescent girls would feel comfortable discussing these issues. Furthermore, 12 Focus Group Discussions (FGDs) were conducted in the schools so that RAs and adolescent girls could become well acquainted with each other, as this is a very sensitive topic to discuss in Bangladesh. In addition, FGDs were conducted in order to evaluate the effectiveness of the intervention using a qualitative approach. After six months of intervention, follow-up data collection was carried out in the schools using the same

questionnaire as used in the baseline regarding knowledge, beliefs, practices, types of complications, and restrictions on menstrual hygiene. RAs visited the students' houses who were not available at school during the follow-up data collection. In students' house RA provided the questionnaire to the students and spoke in a private room to get the answers as the same as school.

This study protocol was reviewed and approved by the ethical committee of Bangladesh Medical Research Council (BMRC). Prior to conducting the baseline survey, participants were informed about the study, invited to participate, and informed of their right to decline. Written consent was obtained from the parents and verbal consent was obtained from the Head teacher, class teacher, and participants. In addition, we obtained written permission for this study from the local Education Officer under the Ministry of Education (MoE) in Bangladesh.

Measures

Intervention components

Knowledge and beliefs about menstruation

This section of the questionnaire consisted of 10 multiple choice questions to determine pupils' knowledge regarding (1) normal monthly duration of menstruation, (2) poor menstrual hygiene predisposing infection, (3) hygienic practices preventing menstrual pain, (4) menstrual blood being considered impure, (5) proper sanitary products, (6) cause of menstruation, (7) origin of menstrual blood, (8) age of normal cessation of menstruation, (9) hot or cold food affecting menstrual cycle, and (10) menstruation as an assurance of fertility (fecundity).

The students' knowledge and beliefs were scored using a system adopted from previous studies. [24-26] Each correct response was awarded one point, whereas any incorrect or "don't

know" answers attained no mark. This gave a total possible score of 10 points. Respondents that scored 0-3 points were adjudged as having poor knowledge, those with 4-7 points, medium knowledge, and those with 8-10 points were considered to have high knowledge. The *Cronbach* α was 0.73 for knowledge and beliefs instrument.

Practices related to menstrual hygiene

This section of the questionnaire consisted of seven items assessing girls' practices of menstrual hygiene: (1) absorbent used during menstruation, (2) frequency of changing out absorbent per day, (3) drying of used absorbent, (4) storing of washed clothes, (5) methods of displace/disposal of the used absorbent, (6) cleaning of external genitalia, and (7) material used for cleaning of external genitalia. A score of 2 was given for good hygienic practices, a score of 1 was given for fair practices, and a score of 0 was given for poor practices. The maximum score was ranged from 0-14 points. Students that scored 0-4 points, 5-8 points, and 9+ points under practice were adjudged as having poor, fair, and good practices respectively. The *Cronbach* α was 0.82 for practice instrument.

Menstrual disorders experienced and restrictions during menstruation

Regarding menstrual disorders experienced by the adolescent, the following items were evaluated: (1) regularity of menstrual cycle, (2) types of complications experienced during menstruation, and (3) consultation with someone for menstrual-related complications. Moreover, this section also consisted of items to assess girls' restrictions during menstruation: (1) visits to holy places, (2) visits to relatives, friends, and neighbors, (3) participation in household activities, and (4) school attendance during menses. Dysmenorrhea was considered as pain in the

abdominal, groin and lumbar regions on the day before or on the first day of menstruation. [27] We also assessed adolescent depression using Children Depression Inventory (CDI). [28] The CDI consists of feelings and ideas grouped into 27 items. The scale scores range from 0 to 54. The *Cronbach α* was 0 .73 for this study. We followed a cut-off score ≥ 20 as depressed. [29-30]

Stress was measured using validated Perceived Stress Scale-10 (PSS). [31-32] The PSS scale scores range was from 0 to 40 with high score represents high social stress. The *Cronbach α* was 0.75. A cut-off score of greater than the median ≥ 20 was considered as high stress mood. [30]

Statistical analysis

Data were cross-checked for consistency before final data entry, using Microsoft Excel. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 18 (SPSS Inc., Chicago, IL, USA). Descriptive analyses were conducted to estimate socio-demographic characteristics of the respondents. We used McNemar's Chi-square analyses as because the same individuals are measured (before and after the survey) twice to evaluate the impact of an education program on four recurrent themes of menstruation: (i) knowledge and beliefs; (ii) menstrual disorders experienced; (iii) hygiene practices; and (iv) menstruation behavior and restrictions of the school-aged adolescent girls between the baseline and the follow-up period. In all analyses, the level of significance was set at $P<0.05$ (two-tailed).

RESULTS

More than half of the respondents (52.4%) were 11 to 13 years old, 13.7%, and 11.8% of the respondents reported that their parents had no education (Table 1). Approximately 95% were

Muslim and 41.8% reported had a household member size six or more. Out of 416 participants, 27.9% were defined as being poor, 34.6% belonged to middle bands of wealth, and 37.5% were defined as being rich. Regarding their house type, 17.1% reported to live in a *pacca*, 14.4% in a *half-pacca*, and 68.5% in a *kancha house* (Table 1).

In the pre-test stage, 77.4%, 68.3%, and 67.1% of girls mentioned that they had knowledge regarding the duration of a normal average menstrual cycle (between 21 to 35 days), that poor menstruation can predispose infection, and that hygienic practices during menstruation period can prevent menstrual pain. In the follow-up period, significantly adolescents reported to have increased ($P<0.001$) their knowledge of these three indicators (93.5%, 95.7%, and 94%). In the follow-up period, adolescents mentioned that they have improved their knowledge that menstrual blood is not impure (67.1% vs 95.9%) and also stated that proper sanitary products should be used for menstrual protection (57.9% vs 81.5%). There was no statistically significant difference between the baseline and the follow-up period regarding respondents' correct knowledge on the cause of menstruation, origin of menstrual blood, or that menstruation was an assurance of fertility. However, during the follow-up period, significantly adolescents reported to have increased their correct knowledge regarding age of normal cessation of menstruation and that there is no influence of hot and cold foods on menstrual cycle. Overall, significant improvement ($P<0.001$) was observed regarding adolescents self-reported high knowledge and beliefs scores at the follow-up period compared with the baseline (51% vs 82.4%; Table 2).

With regards to absorbent used during menstruation, more than 16% of the participants mentioned that they used sanitary pads during menstruation period at the base line and this was increasing to be more than 39% percent after the education program. Frequency of changing pad/cloths per day and drying absorbent outside the room with sunlight was higher in the follow-

up period compared with the baseline. No significant differences were observed in storing of washed clothes between the baseline and the follow-up period. Methods of disposing the absorbent through burial/burning or through dustbin were significantly higher at the follow-up period compared with the baseline. Significant improvement was observed at the follow-up period in cleaning of genitalia every time the toilet was used or during bathing. It was higher at the follow-up period than at the baseline (Table 3). In addition, no significant differences were observed in material used to clean external genitalia between the baseline and the follow-up period. Regarding the practices grading score, participants stated that they have significant improvement (88.9% vs 28.8%) in good practices in the follow-up period compared with the baseline.

At the base line, 94.5% and 78.6% girls reported that they had regular menstrual cycle and had experienced complications during menstruation. In the follow-up period, significant improvement was seen with regard to regular menstrual cycle (99.5%; *P*=0.023) and lowering the complications experience during menstruation (59.6%; *P*=0.003). For the physiological symptoms, a significantly lower number of adolescents reported to be experienced excessive bleeding and greasy skin at the follow-up period compared with the baseline. Regarding dysmenorrheal complexity, significantly lower numbers of adolescents reported experiencing abdominal pain and nausea and or vomiting at the follow-up period. With regard to psychological symptoms, significant differences were observed in experiencing discomfort, stress, and depression between baseline and follow-up period. At the follow-up period, respondents mentioned that they were significantly more likely to consult someone for menstrual related complications than at the baseline (99.8% vs 90.8%; Table 4). During the baseline survey, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation

and 7.7% of girls reported that they did not attend school during menstruation (Table 4). In the follow-up period, significant improvements were observed with regard to restrictions followed by them. No significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses.

DISCUSSION

To the best of our knowledge, this is the first study to evaluate school-based menstrual educational intervention on knowledge, beliefs, and practices of school-aged adolescent girls in Bangladesh. The present study demonstrates that the knowledge and beliefs regarding menstrual hygiene was low before the implementation of the program. After implementation of the program, there was a significant increase in knowledge among the adolescents, from 51% to 82.4%. This finding coincides with those of other studies in Saudi Arabia and Egypt which revealed the same results. [33-34]

Hygiene related practices during menstruation are of considerable importance as it affects health by increasing vulnerability to infection especially infections of the urinary tract and perineum. [4] Poor menstrual hygiene management also effects on reproductive tract infection (RTI) [35]. In this study, only 22.4% of girls are using pad even after the health education. The rest are using poor quality cloths. The cloths are colored using toxic elements which might make them to uterine pain. On the other hand, they dry the cloths inside the room which might effects also. Good hygiene, such as the use of sanitary pads and adequate washing of genital area, is essential during menstruation. [4-6] Girls of reproductive age need access to clean and soft absorbent sanitary products, which in the long run protects their health. In the present study, during the pre-intervention phase, only 28.8% of adolescents had good hygiene practices. In the

post-intervention phase, there was a significant improvement in good menstrual practices (60.1%). Various studies have shown that health education increases knowledge and positive attitudes towards puberty as a natural physiological phenomenon. [36]

Regarding menstrual disorders among adolescent girls, in the pre-intervention phase 10.6% and 6.7% of adolescents reported to be suffered from excessive bleeding and greasy skin. After implementation of the health education program, there was a significant reduction observed regarding such disorders. Dysmenorrhoea is a very common problem among adolescent girls; it affects their quality of life. In the pre-intervention phase 61.5% and 4.6% of adolescents suffered from abdominal pain, nausea, and vomiting; this result is similar to the study done in Egypt. [34, 37] In addition to that, dysmenorrhea (pain during menses) was reported by almost all students in this study, in which 59.8% of them had severe pain followed by back ache and fatigue. This result matched with a study done among Malaysian school girls in 2009. [38] The use of oral contraceptives and hot drinking water may suppress ovulation and reduce menstrual fluid prostaglandin (PG) activity levels which are responsible for the occurrence of dysmenorrheal. Moreover, regular exercise can induce amenorrhea and it may decrease symptoms of dysmeorhhoea. [39] Regarding psychological symptoms, discomfort and stress rate also changed significantly at the follow up period. At the follow-up period, they were more likely to consult someone about menstrual related complications than at the baseline (99.8% vs 90.8%).

This study also demonstrated that during the follow-up period the respondents were reported to have significant improvement in regular menstrual cycle. Possible reason may be due to the fact that after the health education respondents had significantly improved their knowledge, beliefs and good menstrual practices. The other studies also suggest clear links between good menstrual hygiene practices and urinary or reproductive tract infections and other illnesses such

as vaginal scabies, abnormal discharge, and urinary infections. [40] These types of infections can upset the balance of hormones and cause irregular bleeding. [41] In addition, after the health education, participant's discomfort and stress rate also changed significantly. Previous studies also found that, when a woman feels stressed, her adrenal glands secrete the hormone cortisol, which may disrupt normal hormone function and cause irregular bleeding. [42]

During the pre-intervention phase, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% girls reported that they did not attend school during menstruation. In the follow-up, significant improvements were observed with regard to the restrictions followed by them. However, no significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses. These findings therefore illustrate that, there are still greater influences of socio-cultural beliefs and taboos regarding menstruation. Different types of restrictions on menstruating women were also reported by one Indian study [5] where girls do not perform any household work during the menses.

This intervention study provides several important findings and insights for adolescent girls. However, the study had several limitations. First, findings of this study were based on self-reported outcomes and may therefore differ from actual behavior. Adolescents may have over-reported their use of good menstrual hygiene practices in order to satisfy the interviewer. However, all the participants joined the health education session regularly. Second, information about the complications was obtained from the participants, and not from medical records due to time and budget limits, therefore, bias could have occurred that may have affected the reliability of the data. However, our trained RAs received training from physicians in order to collect such information in a reliable manner. Third, although adolescents, who experienced pain in the

abdominal, groin and lumbar regions on the day before or on the first day of menstruation, were considered as dysmenorrhea in this study, however, we could assess the degree of pain by utilizing scale. In future we will certainly consider this point. Finally, this study concluded that education regarding menses has a beneficial impact for the young women in improving normal menstrual cycle. However, it may be possible that, within the passage of time in this young age group would allow more girls to achieve ovulatory and hence regular cycles - so it may be possible that time may help to done this, not the education. A control group of girls of a similar age would be helpful to answer the questionnaire.

Finally, although all possible efforts were made to standardize the educational intervention, it is possible that other environmental factors such as differences in the abilities of RAs and their ability to disseminate study messages could affect the study outcome. Despite such limitations, the results of the present study provide important findings for policy makers to make rational decisions on improving adolescent reproductive health in Bangladesh.

CONCLUSIONS AND RECOMMNEDATION

These results document the feasibility of implementing a health education program on menstrual hygiene in secondary schools serving rural Bangladesh. The program produced significant positive changes in knowledge, beliefs, practices, disorder experiences, and behavior or restrictions regarding menstrual hygiene. More intense or longer interventions may be needed to significantly improve good menstrual hygiene practices in this population. Taking into account the health implications and prevailing socio-cultural and economic factors, there is also an urgent need for intensifying effective strategies to persuade the adolescent school girls to adopt healthy menstrual practices. A well-informed continuous, school education program should be imparted

to the students. In addition, the findings emphasize the inclusion of safe hygiene and sanitary practices that should be included in the school curricula as well as greater communication between female students and teachers and between daughters and mothers.

Acknowledgments This research was supported by 'Honjo International Scholarship Foundation', Japan. The authors would like to thank them for their financial contribution to this important study. We also wish to thank all participants, teachers, and education officers who aided in conducting this research. Finally, we must thank Dr. Nowsheen Sharmin Purabi, Register Gyn. and Obst. at Anwer Khan Medical College, Dhaka, Bangladesh for her training and support for the Research Assistants which made it possible to conduct this research.

Contributors EHS and KS develop the proposal and implement the study. KI and MM was involved in the field study. MR and EHS did the analyses and wrote the manuscript. All authors checked and approved the final manuscript.

Funding This study was funded by "Honjo International Scholarship Foundation', Japan.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

REFERENCES

1. World Health Organization. Adolescent friendly health services. An agenda for change. *World Health Organization*. Geneva: 2002.

2. Marianne E, McPherson E, Korfine L. Menstruation across time: menarche, menstrual attitudes, experiences and behaviors. *Women's Health Issues* 2004; 14: 193-200.

3. Aniebue UU, Aniebue PN, Nwankwo TO. The impact of pre-menarcheal training on menstrual practices and hygiene of Nigerian school girls. *Pan Afr Med J* 2009; 2:9.

4. Rokeya A, Kabita Y. Menstrual hygiene: breaking the silence. *Water Aid Bangladesh* 2007; 283-87.

5. Dasgupta A, Sarkar M. Menstrual hygiene: How Hygienic is the Adolescent Girl? *Indian J Comm Med* 2008; 33:77-80.

6. Menstrual Hygiene. Feminine Hygiene, Gynaecology and Menstruation Information, Resources and Pro-sducts for Dads and Husband. http://www.mens-trualhygiene.com

7. Ayalew T, Meseret Y, Yeshigeta G. Reproductive Health Knowledge and Attitude among Adolescents: A community based study in Jimma Town, Southwest Ethiopia. *Ethiop J Health Dev* 2008; 22: 243-251.

8. Suneela G, Nandini S, Ragini S. Socio-cultural Aspects of Menstruation in an Urban Slum in Delhi, India. *Reprod Health Matters* 2001; 9: 16-25.

9. Olayinka OO, Akinyinka OO. Unmet Need for Sexuality Education among Adolescent Girls in Southwest Nigeria: A Qualitative Analysis. *Afr J Reprod Health* 2004; 8: 27-37.

10. Ahuja A, Tiwari S. Awareness about pubertal changes among adolescent girls. *Journal of Family Welfare* 1995; 41: 46-50.

11. Chaudhari RH. Socio-economic demographic and reproductive health profile of adolescents in the SAARC countries. Paper presented in south Asia Conference on Adolescents; 21-23 July 1998; New Delhi, India.

12. Khanna A, Goyal RS, Bhawsar R. Menstrual practices and reproductive problems: A study of adolescent girls in Rajasthan. *Journal of Health Management* 2005; 7: 91-97.

13. Mudey AB, Keshwani N, Mudey GA, et al. A cross-sectional study on the awareness regarding safe and hygienic practices amongst school going adolescent girls in the rural areas of Wardha district. *Global Journal of Health Science* 2010; 2: 225-231.

14. Bhatia JC, Cleland J. Self-reported symptoms of gynecological morbidity and their treatment in south India. *Studies in Family Planning*1995; 26: 491-495.

15. Mehara S. (Ed), Adolescent Girl: An Indian perspective. MAMTA Health Institute for Mother and Child, Saket, New Delhi. 1995: pp. 75-78.

16. Ghattargi CH, Deo DS. Preparation and Practices regarding Menstruation: A comparative study in Rural and Urban Adolescent Girls. *Indian J of Comm Med* 2005; 30: 10-14.

17. Singh AJ. The place of menstruation in the reproductive lives of women of rural north India. *Indian J of Comm Med* 2006; 31:10-14.

18. Kabir B, Barua MK, Ahmed M. Improving menstrual hygiene facilities in secondary schools Initiatives from BRAC-WASH Program. Dhaka, Bangladesh, 31 January -2 February 2012.

19. Ali A, Mahmud SN, Karim A, et al. Knowledge and practice of NFPE-AGG graduates regarding menstruation. Dhaka: Bangladesh Rural Advancement Committee, 1996.

20. Drakshayani Devi K, Venkata Ramaiah P. A study on menstrual hygiene among rural adolescent girls. Indian *J Med Sci* 1994; 48: 139-143.

21. Narayan KA, Srinivasa DK, Pelto PJ, et al. Puberty rituals, reproductive knowledge and health of adolescent school girls in South India. *AP Pop Jour* 2001; 16: 225-238.

22. Bangladesh Bureau of Statistics (BBS), 2007. *BBS Report* 2007. Government of the People's Republic of Bangladesh. http://www.bbs.gov.bd/Home.aspx accessed on 12 June 2013.

23. Hertzog MA. Considerations in determining sample size for pilot studies. *Res Nurs Health* 2008; 31(2):180-191.

24. Lawan UM, Yusuf NW, Musa AB. Menstruation and Menstrual Hygiene amongst Adolescent School Girls in Kano, Northwestern Nigeria. *Afr J of Reprod Health* 2010; 14: 201-207.

25. Anju A, Patil R. Menstrual Hygiene and Practices of Rural Adolescent Girls of Raichur. *Int J Biol Med Res* 2013; 4: 3014- 3017.

26. El-Gilany AH, Badawi K, El-Fedawy S. Menstrual Hygiene among Adolescent School girls in Mansoura, Egypt. *Reprod Health Matters* 2005; 13:147–152.

27. Liu H, Yang F, Li Z, et al. Passive smoking, Cyp1A1 gene polymorphism and dysmenorrhea. *Reprodu Toxicol* 2007; 24: 114-119. DOI: 10.1016/j.reprotox.2007.04.069.

28. Kovacs M. The children's depression inventory. *Psychopharmacology Bulletin* 1985; 21: 995-998.

29. Kovacs M. Children's Depression Inventory. North Tonawanda, NY: Multi-Health Systems, Inc. 1992.

30. Yaacob SN, Mansor RJ, Ikechukwu AT. Loneliness, stress, self-esteem and depression among Malaysian adolescents. *Jurnal Kemanusiaan Bil.*14, Dis 2009.

31. Cohen S, Karmarck T, Mermelstein R. A global measure of perceived stress. J *Health and Social Behavior* 1983: 24: 385-396.

32. Chakraborti A1, Ray P, Sanyal D, et al. Assessing perceived stress in medical personnel: in search of an appropriate scale for the Bengali population. *Indian J Psychol Med* 2013; 35(1):29-

33. Ayafi SA. Factors associated with health behavior regarding menstruation among Saudi intermediate school girls in Riyadh city. Master thesis, Nursing College, King Saud University 1999.

34. Hassanen H, Tosson M, El-Elkareem EA. Effect of health education and training program for secondary school students on menstruation at Assiut Governorate. *Bulletin of High Institute of Public Health* 2004; 34: 575-94.

35. Sumpter C, Torondel B. A Systematic Review of the Health and Social Effects of Menstrual Hygiene Management. *PLoS ONE* 2013; 8(4): e62004. doi:10.1371/journal.pone.0062004.

36. Afzali M, Allameh R. Study of educational needs of 12-14 years old girls about adolescent health and determines appropriate and effective strategies for adolescent health education. *Koomesh* 2000; 1:39-47.

37. Eswi A, Helal H, Elarousy W. Menstrual attitude and knowledge among Egyptian female adolescents. *J of Am Sci* 2012; 8: 555-565.

38. Lee K, Chen Y, Lee K, et al. Menstruation among adolescent girls in Malaysia: a cross-sectional school survey. *Singapore Medical Journal* 2006; 47: 869-874.

39. Warren MP, Rebecca JL. What is the effect of exercise on primary dysmenorrheal? Products and prostaglandins as a root of menstruation WJSM, 1999; 33: 227.

40. Water Aid, Nepal. Menustraul hygiene in South Asia: a neglected issue for WASH (Water, sanitation, and hygiene) programs. WaterAid, Pokhara, Nepal, 2008. Available at: http://www.wateraid.org/~/media/Publications/menstrual-hygiene-south-asia.pdf accessed on 25 May 2014.

41. Hormone fact sheet. Health and Wellness Institute, Mountlake Terrace, Wa 98043; 2013. Available at http://hwifc.com/wpcontent/uploads/2013/02/Hormone_Fact_Sheet.pdf accessed on 25 May 2014.

42. Markovic N, Markovic O. What Every Woman Should Know about Cervical Cancer. 2008 Springer publication, 2008.

Table 1: Socio-demographic characteristics of the participants (n=416)

Characteristic	Number (n)	Percentage (%)
Age, years		
11-12	64	15.4
13	154	37.0
14+	198	47.6
Religion		
Muslim	394	94.7
Non-Muslim	22	5.3
Father's education		
No education	57	13.7
Incomplete primary	176	42.3
Complete primary	94	22.6
Secondary or higher	89	21.4
Mother's education		
No education	49	11.8
Incomplete primary	173	41.6
Complete primary	119	28.6
Secondary or higher	75	18.0
Household size		
2-4	116	27.9
5	126	30.3
6+	174	41.8
House type		
Pacca	71	17.1
Half-pacca	60	14.4
Kancha	285	68.5
Wealth Index[a]		
Poor	116	27.9
Middle	144	34.6
Rich	156	37.5

[a]Constructed from data on household assets, including ownership of durable goods (such as televisions and bicycles) and dwelling characteristics (such as source of drinking water, sanitation facilities, and construction. We used principal components analyses to assign individual household wealth scores.

Pacca means brick-built; *Half-pacca* means only floor is brick-built and no brick in the roof; *Kancha* means no brick in the house.

Table 2: Impact of menstrual educational program on correct menstruation knowledge and beliefs (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Duration of normal menstruation cycle	322	77.4	389	93.5	16.1	**0.002**
Poor menstruation hygiene predispose to infection	284	68.3	398	95.7	27.4	**<0.001**
Hygiene can prevent menstrual pain	279	67.1	391	94.0	26.9	**<0.001**
Menstruation blood is impure	279	67.1	399	95.9	28.8	**<0.001**
Proper sanitary products should use for menstruation protection	241	57.9	339	81.5	23.6	**<0.001**
Cause of menstruation	334	80.3	353	84.8	4.5	0.886
Origin of menstruation blood	41	9.9	55	13.2	3.3	0.687
Age of normal cessation of menstruation	245	58.9	352	84.6	25.7	**<0.001**
Influence of hot or cold food on menses	273	65.6	358	86.1	20.5	**0.001**
As an assured fertility (fecundity)	179	43.0	190	45.7	2.7	0.556
Knowledge and beliefs grading						
Poor (0-3)	120	28.8	7	1.7	-27.1	**<0.001**
Medium (4-7)	84	20.2	66	15.9	-4.3	
High (8-10)	212	51.0	343	82.4	31.4	

We categorized as poor knowledge (0-3 pints), medium (4-7 points), and high (8-10).

Table 3: Impact of menstrual educational program on menstrual hygienic practices by adolescent girls (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Absorbent used during menstruation						
Sanitary pad	70	16.8	163	39.2	22.4	**0.003**
New cloths	207	49.8	209	50.2	0.4	
Old cloths/others	139	33.4	44	10.6	-22.8	
Frequency of changing pad/cloths per day						
4+ times	35	8.4	321	77.2	68.8	**<0.001**
2-3 times	322	77.4	93	22.4	-55.0	
1 time	59	14.2	2	0.5	-13.7	
Drying of used absorbent						
Outside room with sunlight	78	18.8	401	96.4	77.6	**<0.001**
Inside room with sunlight	46	11.1	5	1.2	-9.9	
Inside/outside room without sunlight	292	70.1	10	2.4	-67.7	
Storing of washed clothes						
Clean and covered place[a]	159	38.2	170	40.8	2.6	0.077
Clean and open space[b]	104	25.0	85	20.4	-4.6	
Unclean and open/covered place[c]	153	36.8	129	31.0	-5.8	
Methods of displace/dispose						
Buried/burn/dustbin	235	56.5	341	82.0	25.5	**0.004**
Latrine	65	15.6	49	11.8	-3.8	
Throw on the roads	116	27.9	26	6.2	-21.7	
Cleaning of genitalia						
Every time during toilet use	65	15.6	145	34.8	19.2	**0.005**
During bathing	202	48.6	254	61.1	12.5	
Do not clean	149	35.8	17	4.1	-31.7	
Material used for cleaning of External genitalia						
Water and antiseptic	30	7.2	45	10.8	3.6	0.448
Soap and Water	199	47.8	191	45.9	-1.9	
Only water/not cleaning	187	45.0	180	43.2	-1.8	
Practice grading						
Poor (0-4)	60	14.4	3	0.7	-13.7	**0.012**
Fair (5-8)	236	56.8	43	10.3	-46.5	
Good (9+)	120	28.8	370	88.9	60.1	

[a]Suitcase, box, cupboard, and shopper; [b]Store room, anywhere in the room, under cushion, under the bed, behind the door, within the washroom; [c]Gallery, under the kitchen roof, anywhere in the room, under cushion, under the bed, behind the door, within the washroom.

Table 4: Impact of menstrual educational program on menstrual disordered experienced, behaviors and restrictions (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Menstrual disorders experienced						
Regularity of menstruation	393	94.5	414	99.5	5.0	**0.023**
Complications during menstruation	327	78.6	248	59.6	-19.0	**0.002**
Types of complications during menstruation						
Physiological symptoms						
Excessive bleeding	44	10.6	13	3.1	-7.5	**<0.001**
Headache	32	7.7	28	6.7	-1.0	0.789
Increase appetite	26	6.2	18	4.3	-1.9	0.297
Greasy skin	28	6.7	6	1.4	-5.3	**0.002**
Dysmenorrhea						
Pain in abdominal/groin/ lumber region	256	61.5	219	52.6	-8.9	**0.012**
Psychological symptoms	35	8.4	13	3.1	-5.3	**0.025**
Discomfort	22	5.3	3	0.7	-4.6	**0.032**
High stress©	16	3.8	6	1.4	-2.4	0.052
Irritability	18	4.3	3	0.7	-3.6	**0.044**
Depression*						
Consult with someone for menstruation related complications	378	90.8	415	99.8	9.0	**0.003**
Behaviors and restrictions						
Visit relatives, friends, and neighbors during menses						
No	189	45.4	110	26.4	-19.0	**0.002**
Yes	227	54.6	306	73.6	19.0	
Doing household activities during menses						
No	94	22.6	85	20.4	-2.2	0.438
Yes	322	77.4	331	79.6	2.2	
Attending school						
No	32	7.7	11	2.6	-5.1	**0.019**
Yes	384	92.3	405	97.4	5.1	

*A cut-off score ≥ 20 as depressed. ©A cut-off score of greater than median ≥ 20 was consider as high stress mood.

Figure 1: Selection of sample.

Effect of school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh

Syed Emdadul Haque,[1, 6*] Mosiur Rahman,[2] Kawashima Itsuko,[3] Mahmuda Mutahara,[4] Kayako Sakisaka [5]

[1]UChicago Research Bangladesh, Dhaka, Bangladesh

[2]International Health and Medicine, Division of Public Health, Graduate School of Medicine, Tokyo Medical and Dental University, Tokyo, Japan

[3]Honjo International Scholarship Foundation, 1-14-9 Tomigaya, Tokyo 151-0063, Japan

[4]Wageningen University, Netherlands

[5]Faculty of Policy Studies, Chuo University, Japan

[6]United Nations University-International Institute for Global Health (UNU-IIGH), Malaysia

***Correspondence author:**
Dr Syed Emdadul Haque
UChicago Research Bangladesh
House #4, Road #2/B, Sector #4, Uttra-1230
Dhaka, Bangladesh
Email address: emdad91@gmail.com; emadad@urb-bd.org; syed.emdadul@unu.edu

ABSTRACT

Objectives: To assess the impact of a school-based menstrual education program on (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) restrictions on menstruating adolescent.

Design: Intervention study.

Setting: Araihazar area in Bangladesh.

Participants: 416 adolescent female students (grade 6-8) and aged between 11-16 years old living with their parents.

Interventions: This school-based health education study was conducted during April 2012 to April 2013.

Primary and secondary outcome measure: Out of 26 high schools in the study area, we randomly selected 3 schools. We delivered six months of educational intervention by trained (Training of the Trainers (TOT) by certified obstetrics and gynecologist) Research Assistants (RAs) on menstrual hygiene among school girls. RAs read the questionnaire and participants answered by them. The changes in knowledge, beliefs, practices, menstrual disorders experienced, and restrictions and behaviors practiced toward menstrual hygiene were compared between the baseline and the follow-up.

Results: After health education, participants reported to have significant improvement (P<0.001) regarding high knowledge and beliefs scores compared with the baseline (51% versus 82.4%). Significant improvement was also observed in overall good menstrual practices (28.8% versus 88.9%) including improvement in using sanitary pads (22.4%; the changes after the intervention), frequency of changing pad/cloths per day (68.8%), drying absorbent (77.6%), methods of disposing the absorbent (25.5%), and cleaning of genitalia (19.2%). During the follow-up, the participants reported significant improvements on regularity of menstrual cycle (94.5% versus 99.5%) and lowering the experiences of complications during menstruation (78.6% versus 59.6%).

Conclusions: The program produced significant changes in the knowledge, beliefs, practices, complications, and behavior or restrictions regarding menstrual hygiene. These results document the feasibility of implementing a health education program for adolescents on menstrual hygiene in secondary schools serving rural Bangladesh.

Keywords: School-based health education; menstrual hygiene; adolescent girls; Bangladesh.

Strengths and limitations of this study

- This is the first evaluation study of menstrual educational program among adolescent school girls in Bangladesh.
- This study evaluated menstrual knowledge, beliefs, and practices of the students of grade 6-8 in Bangladesh. We also evaluated menstrual disorders experienced by the adolescents.
- The educational program showed significant increases on knowledge (51% to 82.4%), belief, and practices (28.8% to 88.9%).
- Significant improvements were also observed with regards to the restrictions on visits to relatives, friends, and attending school during the menstruation.
- The same educational program should implement for all adolescent girls in Bangladesh.

INTRODUCTION

Adolescence is a period of rapid transition in life from girlhood to womanhood. The onset of menstruation is one of the most important changes that occur for girls during the adolescent years.[1] The first menstruation (menarche) occurs between the ages of 11 and 15. [2-3] Poor menstrual hygiene and inadequate self-care are major determinants of morbidity and other complications among this age group such as urinary tract infections, scabies in the vaginal area, abnormal abdominal pain, complications during pregnancy, and absence from schools. [4-7] On the other hand, many parts of developing countries a culture of silence surrounds the topic of menstruation and related issues. [8-9] As a result, many young girls lack appropriate and sufficient information regarding menstrual hygiene. Infections due to lack of hygiene during menstruation have been reported in many studies. [10-15] They also revealed that most adolescent girls had incomplete and inaccurate information about menstrual physiology and hygiene. The menstrual information they did have was acquired primarily through mothers, television, friends, teachers, and relatives. [5, 16-17]

Menstruation is still regarded as something unclean or dirty in Bangladeshi society. [4] Because of various myths, misconceptions, and restrictions practiced during menstruation, adolescent girls in Bangladesh often develop negative attitudes towards this natural physiological phenomenon. The majority of girls lack scientific knowledge about menstruation and puberty. [18] Adolescent girls in Bangladesh are often reluctant to discuss this topic with their parents and hesitant to seek help regarding their menstrual problems. Most girls are not informed about menarche or how to manage menstrual bleeding. [18] Studies in rural Bangladesh and India found that 69.0% of adolescent girls were using old pieces of cloth or even no protection at all during menstruation. [19-20] Therefore, the need to create awareness and increase access to the requisite

sanitary infrastructure related to menstrual hygiene is important for school-aged adolescents in Bangladesh.

Learning menstrual hygiene is a vital part of health education for adolescent' girls so they can carry on regular work/habits throughout their adult life.[21] The ideal menstrual health education curriculum would encourage students to think about the relationships between knowledge, choice, behaviors, and enhanced human health. It would also help to improve maternal health which can impact on MDG5. However, despite the apparent need to achieve millennium development goals (MDGs), to our knowledge no study has been conducted on menstrual hygiene educational intervention among school girls in Bangladesh. Therefore, the present study was designed to evaluate the effectiveness of a school-based menstrual educational program regarding (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) the restrictions practices by 6-8 grade school girls in Bangladesh.

METHODS

Study design and participants

This intervention study was conducted in Araihazar Thana, located at the Narayanganj District in Bangladesh. Araihazar Thana is located 25 km south-east of the capital, Dhaka. The total area of this Thana is 183.35 km² with 63,080 household units and a population of 331,556. Males constitute 51.7% of the population, and females 48.3%. Araihazar has an average literacy rate of 53.0% (7+ years of formal education), compared to the national average of 68.4%. [22]

Out of 26 high schools (grade 6-10) in the study area, 2 were full government schools and 24 were semi-government schools. From these 2 government schools, we selected one and from 24 semi-government schools, we selected two using simple random sampling method (just draw the

number). We only selected 3 schools due to our time limit and resources. In addition, the possible reasons for choosing these schools are that, they were well-established, older schools, and have easy location. From these three schools, one was girls-only and the other two were co-educational. The socioeconomics, cultural norms, religions, and geographical locations of these schools were very similar to each other but not adjacent (distance between the schools was more than 2 kilometers to another). In those three schools, 597 school aged girls were adolescents. Out of 597, 438 were willing to join in the study. However, 22 school aged girl did not reach the age at menarche. Therefore, the final participants were 416 (Figure 1). Participants were selected using the following criteria: (1) they were within grades 6-8, (2) not critically ill, and (3) had achieved menarche. Participants aged were between 11-16 years old and they were living with their parents.

Data collection procedure

Before conducting each interview, SEH, the principal investigator of this study, visited all three schools and received permission to conduct the survey and to provide health education to adolescent girls of the corresponding schools. After the permission, we conducted a pilot survey of the questionnaire and revised as suggested for the final survey. Using the general guidelines, required for a full study we considered 10% of the sample (n=42) for our pilot test in one of the school in the study area. [23] The questionnaires were drafted in English and then translated into Bangla, the national language of Bangladesh. Back-translation from Bangla to English was done before and after the pretest questionnaires were tested, as a validation exercise. We also modified the questionnaire based on the results of the pre-test to make it more understandable and easier for participants to answer. The baseline survey was conducted in April 2012. Trained RAs read

loudly the questions and the answer was given by the participants. A group of 12-15 students were involved in each survey class room lead by one RA and we requested them not to discuss with the peer about the survey questions. After one session, we invited another group for the survey. The room was provided by the schools.

After completion of the baseline survey, we hired one supervisor, a local Obstetrician and Gynecologist, and 3 research assistants (RAs) with good knowledge of the study's target population. Prior to the survey, we gave 4-days training to RAs and one female school teacher (selected from the corresponding schools) on adolescent health education focusing on menstrual hygiene and on the importance of maintaining the confidentiality of the participants' information. The training was done using a field manual which we developed in the Bangla language. Menstrual education focused on knowledge, beliefs, behaviors, and restrictions on menstrual hygiene and also on menstrual disorders among the adolescent girls. The education materials were developed by our employed OB/GYN and ensured culturally acceptable for the girls. They received menstrual health education by the female RAs and in the same class room where they taught regularly. Males were not allowed to entry there during health education. Twelve 45-minute lessons were delivered by the RAs once every 15 days. The lessons were mostly in verbal but RAs showed the clean cloths, pads, and how to dry and store it. Female RAs were recruited for the study, so that adolescent girls would feel comfortable discussing these issues. Furthermore, 12 Focus Group Discussions (FGDs) were conducted in the schools so that RAs and adolescent girls could become well acquainted with each other, as this is a very sensitive topic to discuss in Bangladesh. In addition, FGDs were conducted in order to evaluate the effectiveness of the intervention using a qualitative approach. After six months of intervention, follow-up data collection was carried out in the schools using the same

questionnaire as used in the baseline regarding knowledge, beliefs, practices, types of complications, and restrictions on menstrual hygiene. RAs visited the students' houses who were not available at school during the follow-up data collection. In students' house RA provided the questionnaire to the students and spoke in a private room to get the answers as the same as school.

This study protocol was reviewed and approved by the ethical committee of Bangladesh Medical Research Council (BMRC). Prior to conducting the baseline survey, participants were informed about the study, invited to participate, and informed of their right to decline. Written consent was obtained from the parents and verbal consent was obtained from the Head teacher, class teacher, and participants. In addition, we obtained written permission for this study from the local Education Officer under the Ministry of Education (MoE) in Bangladesh.

Measures

Intervention components

Knowledge and beliefs about menstruation

This section of the questionnaire consisted of 10 multiple choice questions to determine pupils' knowledge regarding (1) normal monthly duration of menstruation, (2) poor menstrual hygiene predisposing infection, (3) hygienic practices preventing menstrual pain, (4) menstrual blood being considered impure, (5) proper sanitary products, (6) cause of menstruation, (7) origin of menstrual blood, (8) age of normal cessation of menstruation, (9) hot or cold food affecting menstrual cycle, and (10) menstruation as an assurance of fertility (fecundity).

The students' knowledge and beliefs were scored using a system adopted from previous studies. [24-26] Each correct response was awarded one point, whereas any incorrect or "don't

know" answers attained no mark. This gave a total possible score of 10 points. Respondents that scored 0-3 points were adjudged as having poor knowledge, those with 4-7 points, medium knowledge, and those with 8-10 points were considered to have high knowledge. The *Cronbach* α was 0.73 for knowledge and beliefs instrument.

Practices related to menstrual hygiene

This section of the questionnaire consisted of seven items assessing girls' practices of menstrual hygiene: (1) absorbent used during menstruation, (2) frequency of changing out absorbent per day, (3) drying of used absorbent, (4) storing of washed clothes, (5) methods of displace/disposal of the used absorbent, (6) cleaning of external genitalia, and (7) material used for cleaning of external genitalia. A score of 2 was given for good hygienic practices, a score of 1 was given for fair practices, and a score of 0 was given for poor practices. The maximum score was ranged from 0-14 points. Students that scored 0-4 points, 5-8 points, and 9+ points under practice were adjudged as having poor, fair, and good practices respectively. The *Cronbach* α was 0.82 for practice instrument.

Menstrual disorders experienced and restrictions during menstruation

Regarding menstrual disorders experienced by the adolescent, the following items were evaluated: (1) regularity of menstrual cycle, (2) types of complications experienced during menstruation, and (3) consultation with someone for menstrual-related complications. Moreover, this section also consisted of items to assess girls' restrictions during menstruation: (1) visits to holy places, (2) visits to relatives, friends, and neighbors, (3) participation in household activities, and (4) school attendance during menses. Dysmenorrhea was considered as pain in the

abdominal, groin and lumbar regions on the day before or on the first day of menstruation. [27] We also assessed adolescent depression using Children Depression Inventory (CDI). [28] The CDI consists of feelings and ideas grouped into 27 items. The scale scores range from 0 to 54. The *Cronbach α* was 0 .73 for this study. We followed a cut-off score ≥ 20 as depressed. [29-30]

Stress was measured using validated Perceived Stress Scale-10 (PSS). [31-32] The PSS scale scores range was from 0 to 40 with high score represents high social stress. The *Cronbach α* was 0.75. A cut-off score of greater than the median ≥ 20 was considered as high stress mood. [30]

Statistical analysis

Data were cross-checked for consistency before final data entry, using Microsoft Excel. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 18 (SPSS Inc., Chicago, IL, USA). Descriptive analyses were conducted to estimate socio-demographic characteristics of the respondents. We used McNemar's Chi-square analyses as because the same individuals are measured (before and after the survey) twice to evaluate the impact of an education program on four recurrent themes of menstruation: (i) knowledge and beliefs; (ii) menstrual disorders experienced; (iii) hygiene practices; and (iv) menstruation behavior and restrictions of the school-aged adolescent girls between the baseline and the follow-up period. In all analyses, the level of significance was set at $P<0.05$ (two-tailed).

RESULTS

More than half of the respondents (52.4%) were 11 to 13 years old, 13.7%, and 11.8% of the respondents reported that their parents had no education (Table 1). Approximately 95% were

Muslim and 41.8% reported had a household member size six or more. Out of 416 participants, 27.9% were defined as being poor, 34.6% belonged to middle bands of wealth, and 37.5% were defined as being rich. Regarding their house type, 17.1% reported to live in a *pacca*, 14.4% in a *half-pacca*, and 68.5% in a *kancha house* (Table 1).

In the pre-test stage, 77.4%, 68.3%, and 67.1% of girls mentioned that they had knowledge regarding the duration of a normal average menstrual cycle (between 21 to 35 days), that poor menstruation can predispose infection, and that hygienic practices during menstruation period can prevent menstrual pain. In the follow-up period, significantly adolescents reported to have increased (P<0.001) their knowledge of these three indicators (93.5%, 95.7%, and 94%). In the follow-up period, adolescents mentioned that they have improved their knowledge that menstrual blood is not impure (67.1% vs 95.9%) and also stated that proper sanitary products should be used for menstrual protection (57.9% vs 81.5%). There was no statistically significant difference between the baseline and the follow-up period regarding respondents' correct knowledge on the cause of menstruation, origin of menstrual blood, or that menstruation was an assurance of fertility. However, during the follow-up period, significantly adolescents reported to have increased their correct knowledge regarding age of normal cessation of menstruation and that there is no influence of hot and cold foods on menstrual cycle. Overall, significant improvement (P<0.001) was observed regarding adolescents self-reported high knowledge and beliefs scores at the follow-up period compared with the baseline (51% vs 82.4%; Table 2).

With regards to absorbent used during menstruation, more than 16% of the participants mentioned that they used sanitary pads during menstruation period at the base line and this was increasing to be more than 39% percent after the education program. Frequency of changing pad/cloths per day and drying absorbent outside the room with sunlight was higher in the follow-

up period compared with the baseline. No significant differences were observed in storing of washed clothes between the baseline and the follow-up period. Methods of disposing the absorbent through burial/burning or through dustbin were significantly higher at the follow-up period compared with the baseline. Significant improvement was observed at the follow-up period in cleaning of genitalia every time the toilet was used or during bathing. It was higher at the follow-up period than at the baseline (Table 3). In addition, no significant differences were observed in material used to clean external genitalia between the baseline and the follow-up period. Regarding the practices grading score, participants stated that they have significant improvement (88.9% vs 28.8%) in good practices in the follow-up period compared with the baseline.

At the base line, 94.5% and 78.6% girls reported that they had regular menstrual cycle and had experienced complications during menstruation. In the follow-up period, significant improvement was seen with regard to regular menstrual cycle (99.5%; *P*=0.023) and lowering the complications experience during menstruation (59.6%; *P*=0.003). For the physiological symptoms, a significantly lower number of adolescents reported to be experienced excessive bleeding and greasy skin at the follow-up period compared with the baseline. Regarding dysmenorrheal complexity, significantly lower numbers of adolescents reported experiencing abdominal pain and nausea and or vomiting at the follow-up period. With regard to psychological symptoms, significant differences were observed in experiencing discomfort, stress, and depression between baseline and follow-up period. At the follow-up period, respondents mentioned that they were significantly more likely to consult someone for menstrual related complications than at the baseline (99.8% vs 90.8%; Table 4). During the baseline survey, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation

and 7.7% of girls reported that they did not attend school during menstruation (Table 4). In the follow-up period, significant improvements were observed with regard to restrictions followed by them. No significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses.

DISCUSSION

To the best of our knowledge, this is the first study to evaluate school-based menstrual educational intervention on knowledge, beliefs, and practices of school-aged adolescent girls in Bangladesh. The present study demonstrates that the knowledge and beliefs regarding menstrual hygiene was low before the implementation of the program. After implementation of the program, there was a significant increase in knowledge among the adolescents, from 51% to 82.4%. This finding coincides with those of other studies in Saudi Arabia and Egypt which revealed the same results. [33-34]

Hygiene related practices during menstruation are of considerable importance as it affects health by increasing vulnerability to infection especially infections of the urinary tract and perineum. [4] Poor menstrual hygiene management also effects on reproductive tract infection (RTI) [35]. In this study, only 22.4% of girls are using pad even after the health education. The rest are using poor quality cloths. The cloths are colored using toxic elements which might make them to uterine pain. On the other hand, they dry the cloths inside the room which might effects also. Good hygiene, such as the use of sanitary pads and adequate washing of genital area, is essential during menstruation. [4-6] Girls of reproductive age need access to clean and soft absorbent sanitary products, which in the long run protects their health. In the present study, during the pre-intervention phase, only 28.8% of adolescents had good hygiene practices. In the

post-intervention phase, there was a significant improvement in good menstrual practices (60.1%). Various studies have shown that health education increases knowledge and positive attitudes towards puberty as a natural physiological phenomenon. [36]

Regarding menstrual disorders among adolescent girls, in the pre-intervention phase 10.6% and 6.7% of adolescents reported to be suffered from excessive bleeding and greasy skin. After implementation of the health education program, there was a significant reduction observed regarding such disorders. Dysmenorrhoea is a very common problem among adolescent girls; it affects their quality of life. In the pre-intervention phase 61.5% and 4.6% of adolescents suffered from abdominal pain, nausea, and vomiting; this result is similar to the study done in Egypt. [34, 37] In addition to that, dysmenorrhea (pain during menses) was reported by almost all students in this study, in which 59.8% of them had severe pain followed by back ache and fatigue. This result matched with a study done among Malaysian school girls in 2009. [38] The use of oral contraceptives and hot drinking water may suppress ovulation and reduce menstrual fluid prostaglandin (PG) activity levels which are responsible for the occurrence of dysmenorrheal. Moreover, regular exercise can induce amenorrhea and it may decrease symptoms of dysmeorhhoea. [39] Regarding psychological symptoms, discomfort and stress rate also changed significantly at the follow up period. At the follow-up period, they were more likely to consult someone about menstrual related complications than at the baseline (99.8% vs 90.8%).

This study also demonstrated that during the follow-up period the respondents were reported to have significant improvement in regular menstrual cycle. Possible reason may be due to the fact that after the health education respondents had significantly improved their knowledge, beliefs and good menstrual practices. The other studies also suggest clear links between good menstrual hygiene practices and urinary or reproductive tract infections and other illnesses such

as vaginal scabies, abnormal discharge, and urinary infections. [40] These types of infections can upset the balance of hormones and cause irregular bleeding. [41] In addition, after the health education, participant's discomfort and stress rate also changed significantly. Previous studies also found that, when a woman feels stressed, her adrenal glands secrete the hormone cortisol, which may disrupt normal hormone function and cause irregular bleeding. [42]

During the pre-intervention phase, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% girls reported that they did not attend school during menstruation. In the follow-up, significant improvements were observed with regard to the restrictions followed by them. However, no significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses. These findings therefore illustrate that, there are still greater influences of socio-cultural beliefs and taboos regarding menstruation. Different types of restrictions on menstruating women were also reported by one Indian study [5] where girls do not perform any household work during the menses.

This intervention study provides several important findings and insights for adolescent girls. However, the study had several limitations. First, findings of this study were based on self-reported outcomes and may therefore differ from actual behavior. Adolescents may have over-reported their use of good menstrual hygiene practices in order to satisfy the interviewer. However, all the participants joined the health education session regularly. Second, information about the complications was obtained from the participants, and not from medical records due to time and budget limits, therefore, bias could have occurred that may have affected the reliability of the data. However, our trained RAs received training from physicians in order to collect such information in a reliable manner. Third, although adolescents, who experienced pain in the

abdominal, groin and lumbar regions on the day before or on the first day of menstruation, were considered as dysmenorrhea in this study, however, we could assess the degree of pain by utilizing scale. In future we will certainly consider this point. Finally, this study concluded that education regarding menses has a beneficial impact for the young women in improving normal menstrual cycle. However, it may be possible that, within the passage of time in this young age group would allow more girls to achieve ovulatory and hence regular cycles - so it may be possible that time may help to done this, not the education. A control group of girls of a similar age would be helpful to answer the questionnaire.

Finally, although all possible efforts were made to standardize the educational intervention, it is possible that other environmental factors such as differences in the abilities of RAs and their ability to disseminate study messages could affect the study outcome. Despite such limitations, the results of the present study provide important findings for policy makers to make rational decisions on improving adolescent reproductive health in Bangladesh.

CONCLUSIONS AND RECOMMNEDATION

These results document the feasibility of implementing a health education program on menstrual hygiene in secondary schools serving rural Bangladesh. The program produced significant positive changes in knowledge, beliefs, practices, disorder experiences, and behavior or restrictions regarding menstrual hygiene. More intense or longer interventions may be needed to significantly improve good menstrual hygiene practices in this population. Taking into account the health implications and prevailing socio-cultural and economic factors, there is also an urgent need for intensifying effective strategies to persuade the adolescent school girls to adopt healthy menstrual practices. A well-informed continuous, school education program should be imparted

to the students. In addition, the findings emphasize the inclusion of safe hygiene and sanitary practices that should be included in the school curricula as well as greater communication between female students and teachers and between daughters and mothers.

Acknowledgments This research was supported by 'Honjo International Scholarship Foundation', Japan. The authors would like to thank them for their financial contribution to this important study. We also wish to thank all participants, teachers, and education officers who aided in conducting this research. Finally, we must thank Dr. Nowsheen Sharmin Purabi, Register Gyn. and Obst. at Anwer Khan Medical College, Dhaka, Bangladesh for her training and support for the Research Assistants which made it possible to conduct this research.

Contributors EHS and KS develop the proposal and implement the study. KI and MM was involved in the field study. MR and EHS did the analyses and wrote the manuscript. All authors checked and approved the final manuscript.

Funding This study was funded by "Honjo International Scholarship Foundation', Japan.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

REFERENCES

1. World Health Organization. Adolescent friendly health services. An agenda for change. *World Health Organization*. Geneva: 2002.

2. Marianne E, McPherson E, Korfine L. Menstruation across time: menarche, menstrual attitudes, experiences and behaviors. *Women's Health Issues* 2004; 14: 193-200.

3. Aniebue UU, Aniebue PN, Nwankwo TO. The impact of pre-menarcheal training on menstrual practices and hygiene of Nigerian school girls. *Pan Afr Med J* 2009; 2:9.

4. Rokeya A, Kabita Y. Menstrual hygiene: breaking the silence. *Water Aid Bangladesh* 2007; 283-87.

5. Dasgupta A, Sarkar M. Menstrual hygiene: How Hygienic is the Adolescent Girl? *Indian J Comm Med* 2008; 33:77-80.

6. Menstrual Hygiene. Feminine Hygiene, Gynaecology and Menstruation Information, Resources and Pro-sducts for Dads and Husband. http://www.mens-trualhygiene.com

7. Ayalew T, Meseret Y, Yeshigeta G. Reproductive Health Knowledge and Attitude among Adolescents: A community based study in Jimma Town, Southwest Ethiopia. *Ethiop J Health Dev* 2008; 22: 243-251.

8. Suneela G, Nandini S, Ragini S. Socio-cultural Aspects of Menstruation in an Urban Slum in Delhi, India. *Reprod Health Matters* 2001; 9: 16-25.

9. Olayinka OO, Akinyinka OO. Unmet Need for Sexuality Education among Adolescent Girls in Southwest Nigeria: A Qualitative Analysis. *Afr J Reprod Health* 2004; 8: 27-37.

10. Ahuja A, Tiwari S. Awareness about pubertal changes among adolescent girls. *Journal of Family Welfare* 1995; 41: 46-50.

11. Chaudhari RH. Socio-economic demographic and reproductive health profile of adolescents in the SAARC countries. Paper presented in south Asia Conference on Adolescents; 21-23 July 1998; New Delhi, India.

12. Khanna A, Goyal RS, Bhawsar R. Menstrual practices and reproductive problems: A study of adolescent girls in Rajasthan. *Journal of Health Management* 2005; 7: 91-97.

13. Mudey AB, Keshwani N, Mudey GA, et al. A cross-sectional study on the awareness regarding safe and hygienic practices amongst school going adolescent girls in the rural areas of Wardha district. *Global Journal of Health Science* 2010; 2: 225-231.

14. Bhatia JC, Cleland J. Self-reported symptoms of gynecological morbidity and their treatment in south India. *Studies in Family Planning*1995; 26: 491-495.

15. Mehara S. (Ed), Adolescent Girl: An Indian perspective. MAMTA Health Institute for Mother and Child, Saket, New Delhi. 1995: pp. 75-78.

16. Ghattargi CH, Deo DS. Preparation and Practices regarding Menstruation: A comparative study in Rural and Urban Adolescent Girls. *Indian J of Comm Med* 2005; 30: 10-14.

17. Singh AJ. The place of menstruation in the reproductive lives of women of rural north India. *Indian J of Comm Med* 2006; 31:10-14.

18. Kabir B, Barua MK, Ahmed M. Improving menstrual hygiene facilities in secondary schools Initiatives from BRAC-WASH Program. Dhaka, Bangladesh, 31 January -2 February 2012.

19. Ali A, Mahmud SN, Karim A, et al. Knowledge and practice of NFPE-AGG graduates regarding menstruation. Dhaka: Bangladesh Rural Advancement Committee, 1996.

20. Drakshayani Devi K, Venkata Ramaiah P. A study on menstrual hygiene among rural adolescent girls. Indian *J Med Sci* 1994; 48: 139-143.

21. Narayan KA, Srinivasa DK, Pelto PJ, et al. Puberty rituals, reproductive knowledge and health of adolescent school girls in South India. *AP Pop Jour* 2001; 16: 225-238.

22. Bangladesh Bureau of Statistics (BBS), 2007. *BBS Report* 2007. Government of the People's Republic of Bangladesh. http://www.bbs.gov.bd/Home.aspx accessed on 12 June 2013.

23. Hertzog MA. Considerations in determining sample size for pilot studies. *Res Nurs Health* 2008; 31(2):180-191.

24. Lawan UM, Yusuf NW, Musa AB. Menstruation and Menstrual Hygiene amongst Adolescent School Girls in Kano, Northwestern Nigeria. *Afr J of Reprod Health* 2010; 14: 201-207.

25. Anju A, Patil R. Menstrual Hygiene and Practices of Rural Adolescent Girls of Raichur. *Int J Biol Med Res* 2013; 4: 3014- 3017.

26. El-Gilany AH, Badawi K, El-Fedawy S. Menstrual Hygiene among Adolescent School girls in Mansoura, Egypt. *Reprod Health Matters* 2005; 13:147–152.

27. Liu H, Yang F, Li Z, et al. Passive smoking, Cyp1A1 gene polymorphism and dysmenorrhea. *Reprodu Toxicol* 2007; 24: 114-119. DOI: 10.1016/j.reprotox.2007.04.069.

28. Kovacs M. The children's depression inventory. *Psychopharmacology Bulletin* 1985; 21: 995-998.

29. Kovacs M. Children's Depression Inventory. North Tonawanda, NY: Multi-Health Systems, Inc. 1992.

30. Yaacob SN, Mansor RJ, Ikechukwu AT. Loneliness, stress, self-esteem and depression among Malaysian adolescents. *Jurnal Kemanusiaan Bil*.14, Dis 2009.

31. Cohen S, Karmarck T, Mermelstein R. A global measure of perceived stress. J *Health and Social Behavior* 1983: 24: 385-396.

32. Chakraborti A1, Ray P, Sanyal D, et al. Assessing perceived stress in medical personnel: in search of an appropriate scale for the Bengali population. *Indian J Psychol Med* 2013; 35(1):29-

33. Ayafi SA. Factors associated with health behavior regarding menstruation among Saudi intermediate school girls in Riyadh city. Master thesis, Nursing College, King Saud University 1999.

34. Hassanen H, Tosson M, El-Elkareem EA. Effect of health education and training program for secondary school students on menstruation at Assiut Governorate. *Bulletin of High Institute of Public Health* 2004; 34: 575-94.

35. Sumpter C, Torondel B. A Systematic Review of the Health and Social Effects of Menstrual Hygiene Management. *PLoS ONE* 2013; 8(4): e62004. doi:10.1371/journal.pone.0062004.

36. Afzali M, Allameh R. Study of educational needs of 12-14 years old girls about adolescent health and determines appropriate and effective strategies for adolescent health education. *Koomesh* 2000; 1:39-47.

37. Eswi A, Helal H, Elarousy W. Menstrual attitude and knowledge among Egyptian female adolescents. *J of Am Sci* 2012; 8: 555-565.

38. Lee K, Chen Y, Lee K, et al. Menstruation among adolescent girls in Malaysia: a cross-sectional school survey. *Singapore Medical Journal* 2006; 47: 869-874.

39. Warren MP, Rebecca JL. What is the effect of exercise on primary dysmenorrheal? Products and prostaglandins as a root of menstruation WJSM, 1999; 33: 227.

40. Water Aid, Nepal. Menustraul hygiene in South Asia: a neglected issue for WASH (Water, sanitation, and hygiene) programs. WaterAid, Pokhara, Nepal, 2008. Available at: http://www.wateraid.org/~/media/Publications/menstrual-hygiene-south-asia.pdf accessed on 25 May 2014.

41. Hormone fact sheet. Health and Wellness Institute, Mountlake Terrace, Wa 98043; 2013. Available at http://hwifc.com/wpcontent/uploads/2013/02/Hormone_Fact_Sheet.pdf accessed on 25 May 2014.

42. Markovic N, Markovic O. What Every Woman Should Know about Cervical Cancer. 2008 Springer publication, 2008.

Table 1: Socio-demographic characteristics of the participants (n=416)

Characteristic	Number (n)	Percentage (%)
Age, years		
11-12	64	15.4
13	154	37.0
14+	198	47.6
Religion		
Muslim	394	94.7
Non-Muslim	22	5.3
Father's education		
No education	57	13.7
Incomplete primary	176	42.3
Complete primary	94	22.6
Secondary or higher	89	21.4
Mother's education		
No education	49	11.8
Incomplete primary	173	41.6
Complete primary	119	28.6
Secondary or higher	75	18.0
Household size		
2-4	116	27.9
5	126	30.3
6+	174	41.8
House type		
Pacca	71	17.1
Half-pacca	60	14.4
Kancha	285	68.5
Wealth Index[a]		
Poor	116	27.9
Middle	144	34.6
Rich	156	37.5

[a]Constructed from data on household assets, including ownership of durable goods (such as televisions and bicycles) and dwelling characteristics (such as source of drinking water, sanitation facilities, and construction. We used principal components analyses to assign individual household wealth scores.

Pacca means brick-built; *Half-pacca* means only floor is brick-built and no brick in the roof; *Kancha* means no brick in the house.

Table 2: Impact of menstrual educational program on correct menstruation knowledge and beliefs (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Duration of normal menstruation cycle	322	77.4	389	93.5	16.1	**0.002**
Poor menstruation hygiene predispose to infection	284	68.3	398	95.7	27.4	**<0.001**
Hygiene can prevent menstrual pain	279	67.1	391	94.0	26.9	**<0.001**
Menstruation blood is impure	279	67.1	399	95.9	28.8	**<0.001**
Proper sanitary products should use for menstruation protection	241	57.9	339	81.5	23.6	**<0.001**
Cause of menstruation	334	80.3	353	84.8	4.5	0.886
Origin of menstruation blood	41	9.9	55	13.2	3.3	0.687
Age of normal cessation of menstruation	245	58.9	352	84.6	25.7	**<0.001**
Influence of hot or cold food on menses	273	65.6	358	86.1	20.5	**0.001**
As an assured fertility (fecundity)	179	43.0	190	45.7	2.7	0.556
Knowledge and beliefs grading						
Poor (0-3)	120	28.8	7	1.7	-27.1	**<0.001**
Medium (4-7)	84	20.2	66	15.9	-4.3	
High (8-10)	212	51.0	343	82.4	31.4	

We categorized as poor knowledge (0-3 pints), medium (4-7 points), and high (8-10).

Table 3: Impact of menstrual educational program on menstrual hygienic practices by adolescent girls (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Absorbent used during menstruation						
Sanitary pad	70	16.8	163	39.2	22.4	**0.003**
New cloths	207	49.8	209	50.2	0.4	
Old cloths/others	139	33.4	44	10.6	-22.8	
Frequency of changing pad/cloths per day						
4+ times	35	8.4	321	77.2	68.8	**<0.001**
2-3 times	322	77.4	93	22.4	-55.0	
1 time	59	14.2	2	0.5	-13.7	
Drying of used absorbent						
Outside room with sunlight	78	18.8	401	96.4	77.6	**<0.001**
Inside room with sunlight	46	11.1	5	1.2	-9.9	
Inside/outside room without sunlight	292	70.1	10	2.4	-67.7	
Storing of washed clothes						
Clean and covered place[a]	159	38.2	170	40.8	2.6	0.077
Clean and open space[b]	104	25.0	85	20.4	-4.6	
Unclean and open/covered place[c]	153	36.8	129	31.0	-5.8	
Methods of displace/dispose						
Buried/burn/dustbin	235	56.5	341	82.0	25.5	**0.004**
Latrine	65	15.6	49	11.8	-3.8	
Throw on the roads	116	27.9	26	6.2	-21.7	
Cleaning of genitalia						
Every time during toilet use	65	15.6	145	34.8	19.2	**0.005**
During bathing	202	48.6	254	61.1	12.5	
Do not clean	149	35.8	17	4.1	-31.7	
Material used for cleaning of External genitalia						
Water and antiseptic	30	7.2	45	10.8	3.6	0.448
Soap and Water	199	47.8	191	45.9	-1.9	
Only water/not cleaning	187	45.0	180	43.2	-1.8	
Practice grading						
Poor (0-4)	60	14.4	3	0.7	-13.7	**0.012**
Fair (5-8)	236	56.8	43	10.3	-46.5	
Good (9+)	120	28.8	370	88.9	60.1	

[a]Suitcase, box, cupboard, and shopper; [b]Store room, anywhere in the room, under cushion, under the bed, behind the door, within the washroom; [c]Gallery, under the kitchen roof, anywhere in the room, under cushion, under the bed, behind the door, within the washroom.

Table 4: Impact of menstrual educational program on menstrual disordered experienced, behaviors and restrictions (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Menstrual disorders experienced						
Regularity of menstruation	393	94.5	414	99.5	5.0	**0.023**
Complications during menstruation	327	78.6	248	59.6	-19.0	**0.002**
Types of complications during menstruation						
Physiological symptoms						
Excessive bleeding	44	10.6	13	3.1	-7.5	**<0.001**
Headache	32	7.7	28	6.7	-1.0	0.789
Increase appetite	26	6.2	18	4.3	-1.9	0.297
Greasy skin	28	6.7	6	1.4	-5.3	**0.002**
Dysmenorrhea						
Pain in abdominal/groin/ lumber region	256	61.5	219	52.6	-8.9	**0.012**
Psychological symptoms	35	8.4	13	3.1	-5.3	**0.025**
Discomfort	22	5.3	3	0.7	-4.6	**0.032**
High stress©	16	3.8	6	1.4	-2.4	0.052
Irritability	18	4.3	3	0.7	-3.6	**0.044**
Depression*						
Consult with someone for menstruation related complications	378	90.8	415	99.8	9.0	**0.003**
Behaviors and restrictions						
Visit relatives, friends, and neighbors during menses						
No	189	45.4	110	26.4	-19.0	**0.002**
Yes	227	54.6	306	73.6	19.0	
Doing household activities during menses						
No	94	22.6	85	20.4	-2.2	0.438
Yes	322	77.4	331	79.6	2.2	
Attending school						
No	32	7.7	11	2.6	-5.1	**0.019**
Yes	384	92.3	405	97.4	5.1	

*A cut-off score ≥ 20 as depressed. ©A cut-off score of greater than median ≥ 20 was consider as high stress mood.

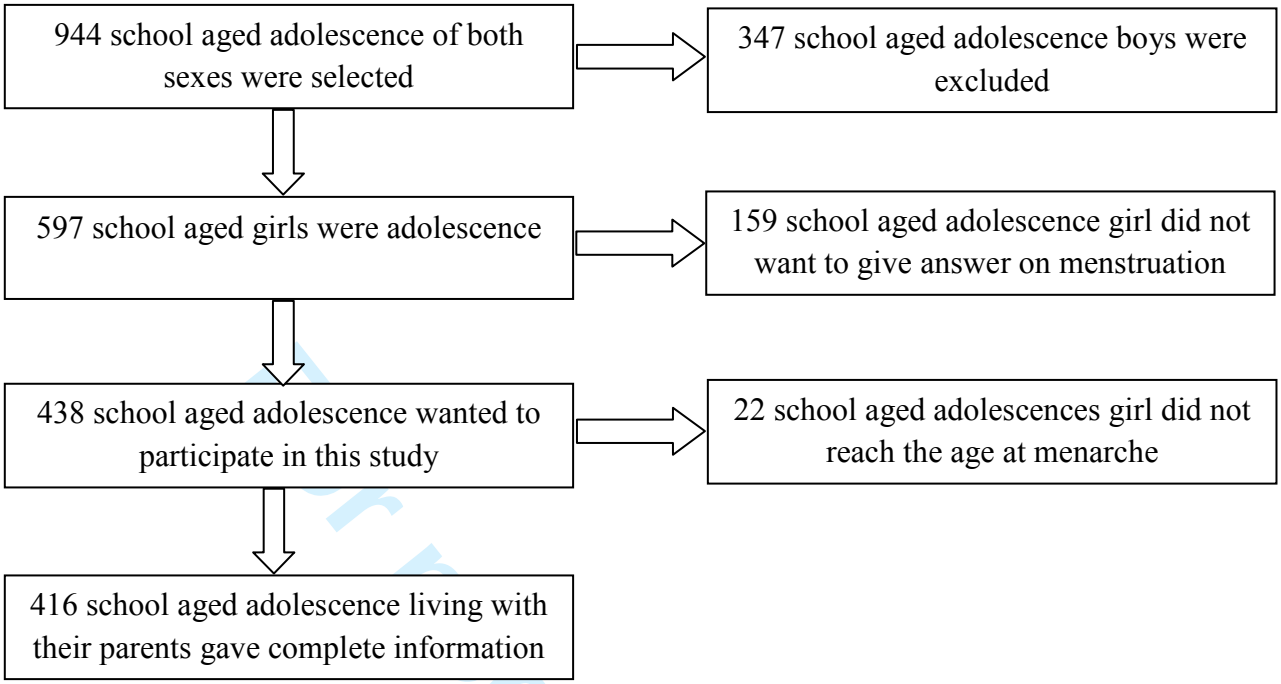
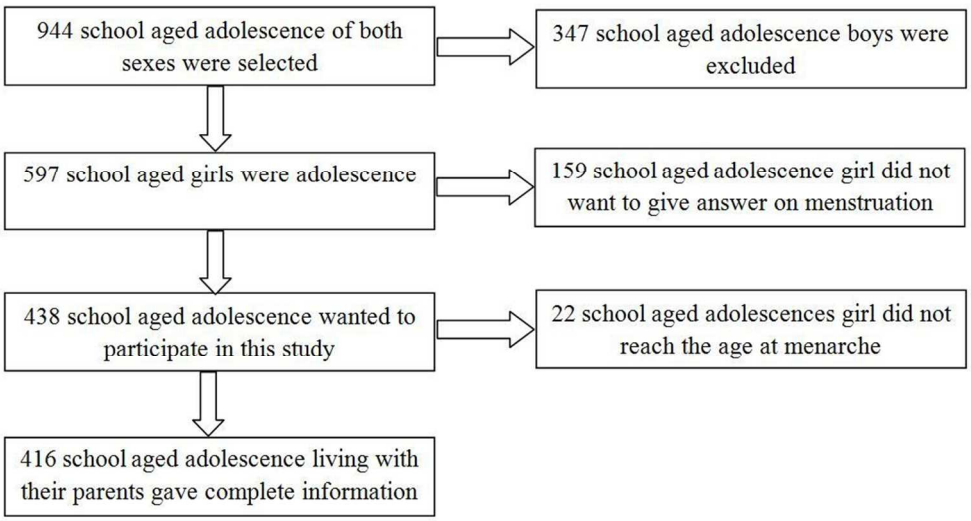


Figure 1: Selection of sample.



90x49mm (300 x 300 DPI)

BMJ Open

The effect of a school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2013-004607.R3
Article Type:	Research
Date Submitted by the Author:	03-Jun-2014
Complete List of Authors:	Haque, Syed; United Nations University-International Institute for Global Health (UNU-IIGH), ; UChicago Research Bangladesh, Rahman, Mosiur; International Health Section, Division of Public Health, Graduate School of Tokyo Medical and Dental University, Itsuko, Kawashima; Honjo International Scholarship Foundation, 1-14-9 Tomigaya, Tokyo 151-0063, Japan, Mutahara, Mahmuda; Wageningen University, Netherlands, Kayako, Sakisaka; Chuo University, Faculty of Policy Studies
Primary Subject Heading:	Public health
Secondary Subject Heading:	Global health
Keywords:	Epidemiology < TROPICAL MEDICINE, EPIDEMIOLOGY, Reproductive medicine < GYNAECOLOGY

The effect of a school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh

Syed Emdadul Haque,[1, 6*] Mosiur Rahman,[2] Kawashima Itsuko,[3] Mahmuda Mutahara,[4] Kayako Sakisaka [5]

[1]UChicago Research Bangladesh, Dhaka, Bangladesh
[2]International Health and Medicine, Division of Public Health, Graduate School of Medicine, Tokyo Medical and Dental University, Tokyo, Japan
[3]Honjo International Scholarship Foundation, 1-14-9 Tomigaya, Tokyo 151-0063, Japan
[4]Wageningen University, Netherlands
[5]Faculty of Policy Studies, Chuo University, Japan
[6]United Nations University-International Institute for Global Health (UNU-IIGH), Malaysia

***Correspondence author:**

Dr Syed Emdadul Haque
UChicago Research Bangladesh
House #4, Road #2/B, Sector #4, Uttra-1230
Dhaka, Bangladesh
Email address: emdad91@gmail.com; emadad@urb-bd.org; syed.emdadul@unu.edu

ABSTRACT

Objectives: To assess the impact of a school-based menstrual education program on (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) restrictions on menstruating adolescents.

Design: Intervention study.

Setting: Araihazar area, Bangladesh.

Participants: 416 adolescent female students in grade 6-8, 11-16 years old, living with their parents.

Interventions: A school-based health education study conducted from April 2012 to April 2013.

Primary and secondary outcome measure: Out of 26 high schools in the study area, we randomly selected 3 schools. We delivered six months of educational intervention by trained (Training of the Trainers (TOT) given by certified obstetrics and gynecologists) Research Assistants (RAs) on menstrual hygiene among school girls. RAs read the questionnaire and participants answered. The changes in knowledge, beliefs, and practices regarding menstruation, menstrual disorders experienced, and the restrictions and behaviors practiced by menstruating adolescents were compared between the baseline and the follow-up assessments.

Results: After health education, participants reported a significant improvement (P<0.001) in "high knowledge and beliefs" scores compared to the baseline (51% versus 82.4%). Significant improvement was also observed in overall good menstrual practices (28.8% versus 88.9%) including improvements in using sanitary pads (22.4%; the change after the intervention), frequency of changing pads/cloths per day (68.8%), drying the used absorbent (77.6%), methods of disposing the absorbent (25.5%), and cleaning of genitalia (19.2%). During the follow-up, the participants reported significant improvements on regularity of menstrual cycle (94.5% versus 99.5%) and lowering of complications during menstruation (78.6% versus 59.6%).

Conclusions: The program produced significant changes in the knowledge, beliefs, and practices of menstrual hygiene, the complications from lack of hygiene, and the behavior and restrictions of the menstruating adolescents. These results document the feasibility of implementing a health education program for adolescents on menstrual hygiene in secondary schools serving rural Bangladesh.

Keywords: School-based health education; menstrual hygiene; adolescent girls; Bangladesh.

Strengths and limitations of this study

- This is the first evaluation study of a menstrual-education program among adolescent school girls in Bangladesh.
- This study evaluated the menstrual knowledge, beliefs, and practices of students grade 6-8 in Bangladesh. We also evaluated menstrual disorders experienced by the adolescents.
- The educational program showed significant increases in knowledge (51% to 82.4%), beliefs, and practices (28.8% to 88.9%).
- Significant improvements were also observed with regards to the restrictions on visits to relatives, friends, and school attendance during menstruation.
- The same educational program should be implemented for all adolescent girls in Bangladesh.

INTRODUCTION

Adolescence is a period of rapid transition in life from girlhood to womanhood. The onset of menstruation is one of the most important changes that occur for girls during the adolescent years.[1] The first menstruation (menarche) occurs between the ages of 11 and 15. [2-3] Poor menstrual hygiene and inadequate self-care are major determinants of morbidity and other complications among this age group. Some of these include urinary tract infections, scabies in the vaginal area, abnormal abdominal pain, complications during pregnancy, and absence from schools. [4-7] In many parts of developing countries a culture of silence surrounds the topic of menstruation and related issues. [8-9] As a result, many young girls lack appropriate and sufficient information regarding menstrual hygiene. Infections due to lack of hygiene during menstruation have been reported in many studies. [10-15] They also revealed that most adolescent girls had incomplete and inaccurate information about menstrual physiology and hygiene. The menstrual information they did have was acquired primarily through mothers, television, friends, teachers, and relatives. [5, 16-17]

Menstruation is still regarded as something unclean or dirty in Bangladeshi society. [4] Because of various myths, misconceptions, and restrictions practiced during menstruation, adolescent girls in Bangladesh often develop negative attitudes towards this natural physiological phenomenon. The majority of girls lack scientific knowledge about menstruation and puberty. [18] Adolescent girls in Bangladesh are often reluctant to discuss this topic with their parents and hesitant to seek help regarding their menstrual problems. Most girls are not informed about menarche or how to manage menstrual bleeding. [18] Studies in rural Bangladesh and India found that 69.0% of adolescent girls were using old pieces of cloth or even no protection at all during menstruation. [19-20] Therefore, the need to create awareness and increase access to the requisite

sanitary infrastructure related to menstrual hygiene is important for school-aged adolescents in Bangladesh.

Learning menstrual hygiene is a vital part of health education for adolescent' girls so they can carry on regular work and habits throughout their adult life.[21] The ideal menstrual health education curriculum would encourage students to think about the relationships between knowledge, choice, behaviors, and enhanced human health. It would also help to improve maternal health which can have an impact on MDGs, for example MDG5. [22] However, despite the apparent need to achieve millennium development goals (MDGs), to our knowledge no study has been conducted on menstrual hygiene educational intervention among school girls in Bangladesh. Therefore, the present study was designed to evaluate the effectiveness of a school-based menstrual education program regarding (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) the restrictions practices by 6-8 grade school girls in Bangladesh.

METHODS

Study design and participants

This intervention study was conducted in Araihazar Thana, located at the Narayanganj District in Bangladesh. Araihazar Thana is located 25 km south-east of the capital, Dhaka. The total area of this Thana is 183.35 km² with 63,080 household units and a population of 331,556. Males constitute 51.7% of the population, and females 48.3%. Araihazar has an average literacy rate of 53.0% (7+ years of formal education), compared to the national average of 68.4%. [23]

Out of 26 high schools (grade 6-10) in the study area, 2 were full government schools and 24 were semi-government schools. From these 2 government schools, we selected one and from the 24 semi-government schools, we selected two, using a simple random sampling method (drew numbers). We only selected 3 schools due to our time limit and resources. In addition, the possible reasons for choosing these schools are that, they were well-established, older schools, and conveniently located. From these three schools, one was girls-only and the other two were co-educational. The socioeconomics, cultural norms, religions, and geographical locations of these schools were very similar to each other but not adjacent (distance between the schools was more than 2 kilometers). In those three schools, 597 school aged girls were adolescents. Out of the 597, 438 were willing to join in the study. However, 22 school aged girls had not yet reached the age of menarche. Therefore, the final participants were 416 (Figure 1). Participants were selected using the following criteria: (1) they were within grades 6-8, (2) not critically ill, and (3) had achieved menarche. Participants were aged between 11-16 years old and they were living with their parents.

Data collection procedure

Before conducting each interview, SEH, the principal investigator of this study, visited all three schools and received permission to conduct the survey and to provide health education to adolescent girls of the corresponding schools. After the permission, we conducted a pilot survey of the questionnaire and revised it, as suggested, for the final survey. Using the general guidelines, required for a full study we considered 10% of the sample (n=42) for our pilot test within one of the schools in the study area. [24] The questionnaires were drafted in English and then translated into Bangla, the national language of Bangladesh. Back-translation from Bangla

to English was done before and after the pretest questionnaires were tested, as a validation exercise. We also modified the questionnaire based on the results of the pre-test to make it more understandable and easier for participants to answer. The baseline survey was conducted in April 2012. Trained RAs read the questions out loud and the participants answered. A group of 12-15 students were involved in each survey class room lead by one RA and we requested them not to discuss the survey questions with their peers. After one session, we invited another group to participate in the survey. The room was provided by the schools.

After completion of the baseline survey, we hired one supervisor, a local Obstetrician and Gynecologist, and 3 research assistants (RAs) with good knowledge of the study's target population. Prior to the survey, we gave 4-days training to RAs and one female school teacher (selected from the corresponding schools) on adolescent health education focusing on menstrual hygiene and on the importance of maintaining the confidentiality of the participants' information. The training was done using a field manual which we developed in the Bangla language. Menstrual education focused on menstrual hygiene knowledge, beliefs, and behaviors, menstrual disorders, and restrictions on menstruating adolescents. The education materials were developed by our employed OB/GYN and ensured culturally acceptable for the girls. They received menstrual health education by the female RAs and in the same class room where they were taught regularly. Males were not allowed entry there during health education. Twelve 45-minute lessons were delivered by the RAs once every 15 days. The lessons were mostly verbal but RAs also demonstrated with clean cloths and pads, and showed how to dry and store them. Female RAs were recruited for the study, so that adolescent girls would feel comfortable discussing these issues. Furthermore, 12 Focus Group Discussions (FGDs) were conducted in the schools so that RAs and adolescent girls could become well acquainted with each other, as this is

a very sensitive topic to discuss in Bangladesh. In addition, FGDs were conducted in order to evaluate the effectiveness of the intervention using a qualitative approach. After six months of intervention, follow-up data collection was carried out in the schools using the same questionnaire as used in the baseline regarding menstrual hygiene knowledge, beliefs and practices, types of complications, and restrictions on menstruating adolescents. RAs visited the students' homes who were not available at school during the follow-up data collection. In students' homes, RAs provided the questionnaire to the students and spoke in a private room to get the answers in keeping with how the data was collected in the schools.

Including other socio-economic data, we also asked the participants about the number of persons per sleeping room in their home; type of floor in the house; type of roof; type of wall; type of cooking fuel; presence of household assets including electricity supply, radio, TV, mobile phone, refrigerator, watch, bicycle, motorcycle, source of drinking water; and, type of sanitary facility.

This study protocol was reviewed and approved by the ethical committee of Bangladesh Medical Research Council (BMRC). Prior to conducting the baseline survey, participants were informed about the study, invited to participate, and informed of their right to decline. Written consent was obtained from the parents and verbal consent was obtained from the Head teacher, class teacher, and participants. In addition, we obtained written permission for this study from the local Education Officer under the Ministry of Education (MoE) in Bangladesh.

Measures

Intervention components

Knowledge and beliefs about menstruation

This section of the questionnaire consisted of 10 multiple choice questions to determine pupils' knowledge regarding (1) normal monthly duration of menstruation, (2) poor menstrual hygiene predisposing infection, (3) hygienic practices preventing menstrual pain, (4) menstrual blood being considered impure, (5) proper sanitary products, (6) cause of menstruation, (7) origin of menstrual blood, (8) age of normal cessation of menstruation, (9) hot or cold food affecting menstrual cycle, and (10) menstruation as an assurance of fertility (fecundity).

The students' knowledge and beliefs were scored using a system adopted from previous studies. [25-27] Each correct response was awarded one point, whereas any incorrect or "don't know" answers attained no mark. This gave a total possible score of 10 points. Respondents that scored 0-3 points were adjudged as having poor knowledge, those with 4-7 points, medium knowledge, and those with 8-10 points were considered to have high knowledge. The *Cronbach* α was 0.73 for knowledge and beliefs instrument.

Practices related to menstrual hygiene

This section of the questionnaire consisted of seven items assessing girls' practices of menstrual hygiene: (1) absorbent used during menstruation, (2) frequency of changing out absorbent per day, (3) drying of used absorbent, (4) storing of washed clothes, (5) methods of displace/disposal of the used absorbent, (6) cleaning of external genitalia, and (7) material used for cleaning of external genitalia. A score of 2 was given for good hygienic practices, a score of 1 was given for fair practices, and a score of 0 was given for poor practices. The maximum score was 14 points.

Students that scored 0-4 points, 5-8 points, and 9+ points under practice were adjudged as having poor, fair, and good practices respectively. The *Cronbach* α was 0.82 for practice instrument.

Menstrual disorders experienced and restrictions during menstruation

Regarding menstrual disorders experienced by the adolescent, the following items were evaluated: (1) regularity of menstrual cycle, (2) types of complications experienced during menstruation, and (3) consultation with someone for menstrual-related complications. Moreover, this section also consisted of items to assess girls' restrictions during menstruation: (1) visits to holy places, (2) visits to relatives, friends, and neighbors, (3) participation in household activities, and (4) school attendance during menses. Dysmenorrhea was considered as pain in the abdominal, groin and lumbar regions on the day before or on the first day of menstruation. [28] We also assessed adolescent depression using the Children Depression Inventory (CDI). [29] The CDI consists of feelings and ideas grouped into 27 items. The scale scores range from 0 to 54. The *Cronbach α* was 0 .73 for this study. We followed a cut-off score ≥ 20 as depressed. [30-31]

Stress was measured using validated Perceived Stress Scale-10 (PSS). [32-33] The PSS scale scores range from 0 to 40 with a high score representing high social stress. The *Cronbach α* was 0.75. A cut-off score of greater than the median ≥ 20 was considered as high stress mood. [31]

Statistical analysis

Data were cross-checked for consistency before final data entry, using Microsoft Excel. One data entry Officer did the data entry and then cross-checked it with the Principal Investigator of the study. Descriptive analyses were conducted to estimate socio-demographic characteristics of the respondents. The household wealth index is used as a proxy indicator for household wealth

status. The wealth index was constructed from existing data on a household's ownership of 15 durable assets and housing materials reported by the participants. Each asset was assigned a weight (factor score) generated through principle components analysis, and the resulting asset scores were standardized in relation to a standard normal distribution with a mean of zero and a standard deviation of one. Each household was then assigned a score for each asset, and the scores were summed by household. The sample was then divided into population tertiles; poor, middle, and rich. We used McNemar's Chi-square analyses as because the same individuals are measured (before and after the survey) twice to evaluate the impact of an education program on four recurrent themes of menstruation: (i) knowledge and beliefs; (ii) menstrual disorders experienced; (iii) hygiene practices; and (iv) menstruation behavior and restrictions of the school-aged adolescent girls between the baseline and the follow-up period. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 18 (SPSS Inc., Chicago, IL, USA). In all analyses, the level of significance was set at $P<0.05$ (two-tailed).

RESULTS

More than half of the respondents (52.4%) were 11 to 13 years old, 13.7%, and 11.8% of the respondents reported that their parents had no education (Table 1). Approximately 95% were Muslim and 41.8% reported had a household member size of six or more. Out of 416 participants, 27.9% were defined as being poor, 34.6% belonged to middle bands of wealth, and 37.5% were defined as being rich. Regarding their house type, 17.1% reported to live in a *pacca*, 14.4% in a *half-pacca*, and 68.5% in a *kancha house* (Table 1).

In the pre-test stage, 77.4%, 68.3%, and 67.1% of girls mentioned that they had knowledge regarding the duration of a normal average menstrual cycle (between 21 to 35 days), that poor menstruation can predispose infection, and that hygienic practices during menstruation period can prevent menstrual pain. In the follow-up period, adolescents reported to have significantly increased (P<0.001) their knowledge of these three indicators (93.5%, 95.7%, and 94%). In the follow-up period, adolescents also mentioned that they improved their knowledge that menstrual blood is not impure (67.1% vs 95.9%) and that proper sanitary products should be used for menstrual protection (57.9% vs 81.5%). There was no statistically significant difference between the baseline and the follow-up period regarding respondents' correct knowledge on the cause of menstruation, origin of menstrual blood, or that menstruation was an assurance of fertility. However, during the follow-up period, significantly, adolescents reported to have increased their correct knowledge regarding age of normal cessation of menstruation and that there is no influence of hot and cold foods on menstrual cycle. Overall, significant improvement (P<0.001) was observed regarding adolescents self-reported high knowledge and beliefs scores at the follow-up period compared with the baseline (51% vs 82.4%; Table 2).

With regards to absorbent used during menstruation, more than 16% of the participants mentioned that they used sanitary pads during menstruation period at the base line and this was increasing to be more than 39% percent after the education program. Frequency of changing pads/cloths per day and drying absorbent outside the room with sunlight was higher in the follow-up period compared with the baseline. No significant differences were observed in storing of washed clothes between the baseline and the follow-up period. Methods of disposing the absorbent through burial/burning or through dustbin were significantly higher at the follow-up period compared with the baseline. Significant improvement was observed at the follow-up

period in cleaning of genitalia every time the toilet was used or during bathing. It was higher at the follow-up period than at the baseline (Table 3). In addition, no significant differences were observed in material used to clean external genitalia between the baseline and the follow-up period. Regarding hygienic practices, participants stated that they had significant improvement (88.9% vs 28.8%) in good practices during the follow-up period compared to the baseline.

At the baseline, 94.5% and 78.6% girls reported that they had regular menstrual cycles and had experienced complications during menstruation. In the follow-up period, significant improvement was seen with regard to regular menstrual cycle (99.5%; P=0.023) and lowering the complications experience during menstruation (59.6%*;* P=0.003). For the physiological symptoms, a significantly lower number of adolescents reported to experience excessive bleeding and greasy skin at the follow-up period compared with the baseline. Regarding dysmenorrheal complexity, significantly lower numbers of adolescents reported experiencing abdominal pain and nausea and or vomiting at the follow-up period. With regard to psychological symptoms, significant differences were observed in experiencing discomfort, stress, and depression between the baseline and follow-up periods. At the follow-up period, respondents mentioned that they were significantly more likely to consult someone for menstrual related complications than at the baseline (99.8% vs 90.8%; Table 4). During the baseline survey, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% of girls reported that they did not attend school during menstruation (Table 4). In the follow-up period, significant improvements were observed with regard to restrictions followed by them. No significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses.

DISCUSSION

To the best of our knowledge, this is the first study to evaluate school-based menstrual educational intervention on knowledge, beliefs, and practices of school-aged adolescent girls in Bangladesh. The present study demonstrates that the knowledge and beliefs regarding menstrual hygiene was low before the implementation of the program. After implementation of the program, there was a significant increase in knowledge among the adolescents, from 51% to 82.4%. This finding coincides with those of other studies in Saudi Arabia and Egypt which revealed the same results. [34-35]

Hygiene related practices during menstruation are of considerable importance as it affects health by increasing vulnerability to infection especially infections of the urinary tract and perineum. [4] Poor menstrual hygiene management also effects reproductive tract infection (RTI). [36] In this study, only 22.4% of girls are using pads even after the health education. The rest are using poor quality cloths. The cloths are colored using toxic elements which might make them susceptible to uterine pain. On the other hand, they dry the cloths inside the room which might have effects also. Good hygiene, such as the use of sanitary pads and adequate washing of genital area, is essential during menstruation. [4-6] Girls of reproductive age need access to clean and soft absorbent sanitary products, which in the long run protects their health. In the present study, during the pre-intervention phase, only 28.8% of adolescents had good hygiene practices. In the post-intervention phase, there was a significant improvement in good menstrual practices (60.1%). Various studies have shown that health education increases knowledge and positive attitudes towards puberty as a natural physiological phenomenon. [37]

Regarding menstrual disorders among adolescent girls, in the pre-intervention phase 10.6% and 6.7% of adolescents reported suffering from excessive bleeding and greasy skin. After

implementation of the health education program, there was a significant reduction observed regarding such disorders. Dysmenorrhoea is a very common problem among adolescent girls; it affects their quality of life. In the pre-intervention phase 61.5% and 4.6% of adolescents suffered from abdominal pain, nausea, and vomiting; this result is similar to the study done in Egypt. [35, 38] In addition to that, dysmenorrhea (pain during menses) was reported by almost all students in this study, in which 59.8% of them had severe pain followed by back ache and fatigue. This result matched with a study done among Malaysian school girls in 2009. [39] The use of oral contraceptives and hot drinking water may suppress ovulation and reduce menstrual fluid prostaglandin (PG) activity levels which are responsible for the occurrence of dysmenorrheal. Moreover, regular exercise can induce amenorrhea and it may decrease symptoms of dysmeorhhoea. [40] Regarding psychological symptoms, discomfort and stress rate also changed significantly at the follow-up period. At the follow-up period, they were more likely to consult someone about menstrual related complications than at the baseline (99.8% vs 90.8%).

This study also demonstrated that during the follow-up period the respondents were reported to have significant improvements in regular menstrual cycles. Possible reason may be due to the fact that after the health education respondents had significantly improved their knowledge, beliefs and good menstrual practices. The other studies also suggest clear links between good menstrual hygiene practices and urinary or reproductive tract infections and other illnesses such as vaginal scabies, abnormal discharge, and urinary infections. [41] These types of infections can upset the balance of hormones and cause irregular bleeding. [42] In addition, after the health education, participant's discomfort and stress rate also changed significantly. Previous studies also found that, when a woman feels stressed, her adrenal glands secrete the hormone cortisol, which may disrupt normal hormone function and cause irregular bleeding. [43]

During the pre-intervention phase, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% girls reported that they did not attend school during menstruation. In the follow-up, significant improvements were observed with regard to the restrictions followed by them. However, no significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses. These findings therefore illustrate that, there are still greater influences of socio-cultural beliefs and taboos regarding menstruation. Different types of restrictions on menstruating women were also reported by one Indian study [5] where girls do not perform any household work during the menses.

This intervention study provides several important findings and insights for adolescent girls. However, the study had several limitations. First, findings of this study were based on self-reported outcomes and may therefore differ from actual behavior. Adolescents may have over-reported their use of good menstrual hygiene practices in order to satisfy the interviewer. However, all the participants joined the health education session regularly. Second, information about the complications was obtained from the participants, and not from medical records due to time and budget limits, therefore, bias could have occurred that may have affected the reliability of the data. However, our trained RAs received training from physicians in order to collect such information in a reliable manner. Third, although adolescent who experienced pain in the abdominal, groin and lumbar regions on the day before or on the first day of menstruation, were considered as dysmenorrhea in this study, we could assess the degree of pain by utilizing scale. In future we will certainly consider this point. Finally, this study concluded that education regarding menses has a beneficial impact for young women in improving normal menstrual cycles. However, it may be possible that, within the passage of time in this young age group

would allow more girls to achieve ovulatory and hence regular cycles/as the young adolescent girls' bodies grow and mature they will naturally achieve more regular cycles- so it may be possible that time may help do this, not the education. A control group of girls of a similar age would be helpful to answer the questionnaire.

Finally, although all possible efforts were made to standardize the educational intervention, it is possible that other environmental factors such as differences in the abilities of RAs and their ability to disseminate study messages could affect the study outcome. Despite such limitations, the results of the present study provide important findings for policy makers to make rational decisions on improving adolescent reproductive health in Bangladesh.

CONCLUSIONS AND RECOMMNEDATION

These results document the feasibility of implementing a health education program on menstrual hygiene in secondary schools serving rural Bangladesh. The program produced significant positive changes in knowledge, beliefs, practices towards menstrual hygiene, disorder experiences, and restrictions on menstruating adolescents. More intense or longer interventions may be needed to significantly improve good menstrual hygiene practices in this population. Taking into account the health implications and prevailing socio-cultural and economic factors, there is also an urgent need for intensifying effective strategies to persuade the adolescent school girls to adopt healthy menstrual practices. A well-informed continuous, school education program should be imparted to the students. In addition, the findings emphasize the inclusion of safe hygiene and sanitary practices that should be included in the school curricula as well as greater communication between female students and teachers and between daughters and mothers.

Acknowledgments This research was supported by 'Honjo International Scholarship Foundation', Japan. The authors would like to thank them for their financial contribution to this important study. We also wish to thank all participants, teachers, and education officers who aided in conducting this research. Finally, we must thank Dr. Nowsheen Sharmin Purabi, Register Gyn. and Obst. at Anwer Khan Medical College, Dhaka, Bangladesh for her training and support for the Research Assistants which made it possible to conduct this research.

Contributors EHS and KS develop the proposal and implement the study. KI and MM was involved in the field study. MR and EHS did the analyses and wrote the manuscript. All authors checked and approved the final manuscript.

Funding This study was funded by "Honjo International Scholarship Foundation', Japan.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

REFERENCES

1. World Health Organization. Adolescent friendly health services. An agenda for change. *World Health Organization*. Geneva: 2002.

2. Marianne E, McPherson E, Korfine L. Menstruation across time: menarche, menstrual attitudes, experiences and behaviors. *Women's Health Issues* 2004; 14: 193-200.

3. Aniebue UU, Aniebue PN, Nwankwo TO. The impact of pre-menarcheal training on menstrual practices and hygiene of Nigerian school girls. *Pan Afr Med J* 2009; 2:9.

4. Rokeya A, Kabita Y. Menstrual hygiene: breaking the silence. *Water Aid Bangladesh* 2007; 283-87.

5. Dasgupta A, Sarkar M. Menstrual hygiene: How Hygienic is the Adolescent Girl? *Indian J Comm Med* 2008; 33:77-80.

6. Menstrual Hygiene. Feminine Hygiene, Gynaecology and Menstruation Information, Resources and Pro-sducts for Dads and Husband. http://www.mens-trualhygiene.com

7. Ayalew T, Meseret Y, Yeshigeta G. Reproductive Health Knowledge and Attitude among Adolescents: A community based study in Jimma Town, Southwest Ethiopia. *Ethiop J Health Dev* 2008; 22: 243-251.

8. Suneela G, Nandini S, Ragini S. Socio-cultural Aspects of Menstruation in an Urban Slum in Delhi, India. *Reprod Health Matters* 2001; 9: 16-25.

9. Olayinka OO, Akinyinka OO. Unmet Need for Sexuality Education among Adolescent Girls in Southwest Nigeria: A Qualitative Analysis. *Afr J Reprod Health* 2004; 8: 27-37.

10. Ahuja A, Tiwari S. Awareness about pubertal changes among adolescent girls. *Journal of Family Welfare* 1995; 41: 46-50.

11. Chaudhari RH. Socio-economic demographic and reproductive health profile of adolescents in the SAARC countries. Paper presented in south Asia Conference on Adolescents; 21-23 July 1998; New Delhi, India.

12. Khanna A, Goyal RS, Bhawsar R. Menstrual practices and reproductive problems: A study of adolescent girls in Rajasthan. *Journal of Health Management* 2005; 7: 91-97.

13. Mudey AB, Keshwani N, Mudey GA, et al. A cross-sectional study on the awareness regarding safe and hygienic practices amongst school going adolescent girls in the rural areas of Wardha district. *Global Journal of Health Science* 2010; 2: 225-231.

14. Bhatia JC, Cleland J. Self-reported symptoms of gynecological morbidity and their treatment in south India. *Studies in Family Planning*1995; 26: 491-495.

15. Mehara S. (Ed), Adolescent Girl: An Indian perspective. MAMTA Health Institute for Mother and Child, Saket, New Delhi. 1995: pp. 75-78.

16. Ghattargi CH, Deo DS. Preparation and Practices regarding Menstruation: A comparative study in Rural and Urban Adolescent Girls. *Indian J of Comm Med* 2005; 30: 10-14.

17. Singh AJ. The place of menstruation in the reproductive lives of women of rural north India. *Indian J of Comm Med* 2006; 31:10-14.

18. Kabir B, Barua MK, Ahmed M. Improving menstrual hygiene facilities in secondary schools Initiatives from BRAC-WASH Program. Dhaka, Bangladesh, 31 January -2 February 2012.

19. Ali A, Mahmud SN, Karim A, et al. Knowledge and practice of NFPE-AGG graduates regarding menstruation. Dhaka: Bangladesh Rural Advancement Committee, 1996.

20. Drakshayani Devi K, Venkata Ramaiah P. A study on menstrual hygiene among rural adolescent girls. Indian *J Med Sci* 1994; 48: 139-143.

21. Narayan KA, Srinivasa DK, Pelto PJ, et al. Puberty rituals, reproductive knowledge and health of adolescent school girls in South India. *AP Pop Jour* 2001; 16: 225-238.

22. Ten VTA. Menstrual Hygiene: A Neglected Condition for the Achievement of Several Millennium Development Goals. Zoetermeer: Europe External Policy Advisors (EEPA), 2007. http://www.wsscc.org/resources/resource-publications/menstrual-hygiene-neglected-condition-achievement-several-mdgs accessed on 30 May 2014.

23. Bangladesh Bureau of Statistics (BBS), 2007. *BBS Report* 2007. Government of the People's Republic of Bangladesh. http://www.bbs.gov.bd/Home.aspx accessed on 12 June 2013.

24. Hertzog MA. Considerations in determining sample size for pilot studies. *Res Nurs Health* 2008; 31(2):180-191.

25. Lawan UM, Yusuf NW, Musa AB. Menstruation and Menstrual Hygiene amongst Adolescent School Girls in Kano, Northwestern Nigeria. *Afr J of Reprod Health* 2010; 14: 201-207.

26. Anju A, Patil R. Menstrual Hygiene and Practices of Rural Adolescent Girls of Raichur. *Int J Biol Med Res* 2013; 4: 3014- 3017.

27. El-Gilany AH, Badawi K, El-Fedawy S. Menstrual Hygiene among Adolescent School girls in Mansoura, Egypt. *Reprod Health Matters* 2005; 13:147–152.

28. Liu H, Yang F, Li Z, et al. Passive smoking, Cyp1A1 gene polymorphism and dysmenorrhea. *Reprodu Toxicol* 2007; 24: 114-119. DOI: 10.1016/j.reprotox.2007.04.069.

29. Kovacs M. The children's depression inventory. *Psychopharmacology Bulletin* 1985; 21: 995-998.

30. Kovacs M. Children's Depression Inventory. North Tonawanda, NY: Multi-Health Systems, Inc. 1992.

31. Yaacob SN, Mansor RJ, Ikechukwu AT. Loneliness, stress, self-esteem and depression among Malaysian adolescents. *Jurnal Kemanusiaan Bil*.14, Dis 2009.

32. Cohen S, Karmarck T, Mermelstein R. A global measure of perceived stress. J *Health and Social Behavior* 1983: 24: 385-396.

33. Chakraborti A1, Ray P, Sanyal D, et al. Assessing perceived stress in medical personnel: in search of an appropriate scale for the Bengali population. *Indian J Psychol Med* 2013; 35(1):29-

34. Ayafi SA. Factors associated with health behavior regarding menstruation among Saudi intermediate school girls in Riyadh city. Master thesis, Nursing College, King Saud University 1999.

35. Hassanen H, Tosson M, El-Elkareem EA. Effect of health education and training program for secondary school students on menstruation at Assiut Governorate. *Bulletin of High Institute of Public Health* 2004; 34: 575-94.

36. Sumpter C, Torondel B. A Systematic Review of the Health and Social Effects of Menstrual Hygiene Management. *PLoS ONE* 2013; 8(4): e62004. doi:10.1371/journal.pone.0062004.

37. Afzali M, Allameh R. Study of educational needs of 12-14 years old girls about adolescent health and determines appropriate and effective strategies for adolescent health education. *Koomesh* 2000; 1:39-47.

38. Eswi A, Helal H, Elarousy W. Menstrual attitude and knowledge among Egyptian female adolescents. *J of Am Sci* 2012; 8: 555-565.

39. Lee K, Chen Y, Lee K, et al. Menstruation among adolescent girls in Malaysia: a cross-sectional school survey. *Singapore Medical Journal* 2006; 47: 869-874.

40. Warren MP, Rebecca JL. What is the effect of exercise on primary dysmenorrheal? Products and prostaglandins as a root of menstruation WJSM, 1999; 33: 227.

41. Water Aid, Nepal. Menustraul hygiene in South Asia: a neglected issue for WASH (Water, sanitation, and hygiene) programs. WaterAid, Pokhara, Nepal, 2008. Available at: http://www.wateraid.org/~/media/Publications/menstrual-hygiene-south-asia.pdf accessed on 25 May 2014.

42. Hormone fact sheet. Health and Wellness Institute, Mountlake Terrace, Wa 98043; 2013. Available at http://hwifc.com/wpcontent/uploads/2013/02/Hormone_Fact_Sheet.pdf accessed on 25 May 2014.

43. Markovic N, Markovic O. What Every Woman Should Know about Cervical Cancer. 2008 Springer publication, 2008.

Table 1: Socio-demographic characteristics of the participants (n=416)

Characteristic	Number (n)	Percentage (%)
Age, years		
11-12	64	15.4
13	154	37.0
14+	198	47.6
Religion		
Muslim	394	94.7
Non-Muslim	22	5.3
Father's education		
No education	57	13.7
Incomplete primary	176	42.3
Complete primary	94	22.6
Secondary or higher	89	21.4
Mother's education		
No education	49	11.8
Incomplete primary	173	41.6
Complete primary	119	28.6
Secondary or higher	75	18.0
Household size		
2-4	116	27.9
5	126	30.3
6+	174	41.8
House type		
Pacca	71	17.1
Half-pacca	60	14.4
Kancha	285	68.5
Wealth Index[a]		
Poor	116	27.9
Middle	144	34.6
Rich	156	37.5

[a]Constructed from data on household assets, including ownership of durable goods (such as televisions and bicycles) and dwelling characteristics (such as source of drinking water, sanitation facilities, and construction. We used principal components analyses to assign individual household wealth scores.

Pacca means brick-built; *Half-pacca* means only floor is brick-built and no brick in the roof; *Kancha* means no brick in the house.

Table 2: Impact of menstrual educational program on correct menstruation knowledge and beliefs (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Duration of normal menstruation cycle	322	77.4	389	93.5	16.1	**0.002**
Poor menstruation hygiene predispose to infection	284	68.3	398	95.7	27.4	**<0.001**
Hygiene can prevent menstrual pain	279	67.1	391	94.0	26.9	**<0.001**
Menstruation blood is impure	279	67.1	399	95.9	28.8	**<0.001**
Proper sanitary products should use for menstruation protection	241	57.9	339	81.5	23.6	**<0.001**
Cause of menstruation	334	80.3	353	84.8	4.5	0.886
Origin of menstruation blood	41	9.9	55	13.2	3.3	0.687
Age of normal cessation of menstruation	245	58.9	352	84.6	25.7	**<0.001**
Influence of hot or cold food on menses	273	65.6	358	86.1	20.5	**0.001**
As an assured fertility (fecundity)	179	43.0	190	45.7	2.7	0.556
Knowledge and beliefs grading						
Poor (0-3)	120	28.8	7	1.7	-27.1	**<0.001**
Medium (4-7)	84	20.2	66	15.9	-4.3	
High (8-10)	212	51.0	343	82.4	31.4	

We categorized as poor knowledge (0-3 pints), medium (4-7 points), and high (8-10).

Table 3: Impact of menstrual educational program on menstrual hygienic practices by adolescent girls (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Absorbent used during menstruation						
Sanitary pad	70	16.8	163	39.2	22.4	**0.003**
New cloths	207	49.8	209	50.2	0.4	
Old cloths/others	139	33.4	44	10.6	-22.8	
Frequency of changing pad/cloths per day						
4+ times	35	8.4	321	77.2	68.8	**<0.001**
2-3 times	322	77.4	93	22.4	-55.0	
1 time	59	14.2	2	0.5	-13.7	
Drying of used absorbent						
Outside room with sunlight	78	18.8	401	96.4	77.6	**<0.001**
Inside room with sunlight	46	11.1	5	1.2	-9.9	
Inside/outside room without sunlight	292	70.1	10	2.4	-67.7	
Storing of washed clothes						
Clean and covered place[a]	159	38.2	170	40.8	2.6	0.077
Clean and open space[b]	104	25.0	85	20.4	-4.6	
Unclean and open/covered place[c]	153	36.8	129	31.0	-5.8	
Methods of displace/dispose						
Buried/burn/dustbin	235	56.5	341	82.0	25.5	**0.004**
Latrine	65	15.6	49	11.8	-3.8	
Throw on the roads	116	27.9	26	6.2	-21.7	
Cleaning of genitalia						
Every time during toilet use	65	15.6	145	34.8	19.2	**0.005**
During bathing	202	48.6	254	61.1	12.5	
Do not clean	149	35.8	17	4.1	-31.7	
Material used for cleaning of External genitalia						
Water and antiseptic	30	7.2	45	10.8	3.6	0.448
Soap and Water	199	47.8	191	45.9	-1.9	
Only water/not cleaning	187	45.0	180	43.2	-1.8	
Practice grading						
Poor (0-4)	60	14.4	3	0.7	-13.7	**0.012**
Fair (5-8)	236	56.8	43	10.3	-46.5	
Good (9+)	120	28.8	370	88.9	60.1	

[a]Suitcase, box, cupboard, and shopper; [b]Store room, anywhere in the room, under cushion, under the bed, behind the door, within the washroom; [c]Gallery, under the kitchen roof, anywhere in the room, under cushion, under the bed, behind the door, within the washroom.

Table 4: Impact of menstrual educational program on menstrual disordered experienced, behaviors and restrictions (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Menstrual disorders experienced						
Regularity of menstruation	393	94.5	414	99.5	5.0	**0.023**
Complications during menstruation	327	78.6	248	59.6	-19.0	**0.002**
Types of complications during menstruation						
Physiological symptoms						
Excessive bleeding	44	10.6	13	3.1	-7.5	**<0.001**
Headache	32	7.7	28	6.7	-1.0	0.789
Increase appetite	26	6.2	18	4.3	-1.9	0.297
Greasy skin	28	6.7	6	1.4	-5.3	**0.002**
Dysmenorrhea						
Pain in abdominal/groin/ lumber region	256	61.5	219	52.6	-8.9	**0.012**
Psychological symptoms	35	8.4	13	3.1	-5.3	**0.025**
Discomfort	22	5.3	3	0.7	-4.6	**0.032**
High stress©	16	3.8	6	1.4	-2.4	0.052
Irritability	18	4.3	3	0.7	-3.6	**0.044**
Depression*						
Consult with someone for menstruation related complications	378	90.8	415	99.8	9.0	**0.003**
Behaviors and restrictions						
Visit relatives, friends, and neighbors during menses						
No	189	45.4	110	26.4	-19.0	**0.002**
Yes	227	54.6	306	73.6	19.0	
Doing household activities during menses						
No	94	22.6	85	20.4	-2.2	0.438
Yes	322	77.4	331	79.6	2.2	
Attending school						
No	32	7.7	11	2.6	-5.1	**0.019**
Yes	384	92.3	405	97.4	5.1	

*A cut-off score ≥ 20 as depressed. ©A cut-off score of greater than median ≥ 20 was consider as high stress mood.

Figure 1: Selection of sample.

The effect of a school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh

Syed Emdadul Haque,[1, 6*] Mosiur Rahman,[2] Kawashima Itsuko,[3] Mahmuda Mutahara,[4] Kayako Sakisaka [5]

[1]UChicago Research Bangladesh, Dhaka, Bangladesh
[2]International Health and Medicine, Division of Public Health, Graduate School of Medicine, Tokyo Medical and Dental University, Tokyo, Japan
[3]Honjo International Scholarship Foundation, 1-14-9 Tomigaya, Tokyo 151-0063, Japan
[4]Wageningen University, Netherlands
[5]Faculty of Policy Studies, Chuo University, Japan
[6]United Nations University-International Institute for Global Health (UNU-IIGH), Malaysia

***Correspondence author:**

Dr Syed Emdadul Haque
UChicago Research Bangladesh
House #4, Road #2/B, Sector #4, Uttra-1230
Dhaka, Bangladesh
Email address: emdad91@gmail.com; emadad@urb-bd.org; syed.emdadul@unu.edu

ABSTRACT

Objectives: To assess the impact of a school-based menstrual education program on (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) restrictions on menstruating adolescents.

Design: Intervention study.

Setting: Araihazar area, Bangladesh.

Participants: 416 adolescent female students in grade 6-8, 11-16 years old, living with their parents.

Interventions: A school-based health education study conducted from April 2012 to April 2013.

Primary and secondary outcome measure: Out of 26 high schools in the study area, we randomly selected 3 schools. We delivered six months of educational intervention by trained (Training of the Trainers (TOT) given by certified obstetrics and gynecologists) Research Assistants (RAs) on menstrual hygiene among school girls. RAs read the questionnaire and participants answered. The changes in knowledge, beliefs, and practices regarding menstruation, menstrual disorders experienced, and the restrictions and behaviors practiced by menstruating adolescents were compared between the baseline and the follow-up assessments.

Results: After health education, participants reported a significant improvement (P<0.001) in "high knowledge and beliefs" scores compared to the baseline (51% versus 82.4%). Significant improvement was also observed in overall good menstrual practices (28.8% versus 88.9%) including improvements in using sanitary pads (22.4%; the change after the intervention), frequency of changing pads/cloths per day (68.8%), drying the used absorbent (77.6%), methods of disposing the absorbent (25.5%), and cleaning of genitalia (19.2%). During the follow-up, the participants reported significant improvements on regularity of menstrual cycle (94.5% versus 99.5%) and lowering of complications during menstruation (78.6% versus 59.6%).

Conclusions: The program produced significant changes in the knowledge, beliefs, and practices of menstrual hygiene, the complications from lack of hygiene, and the behavior and restrictions of the menstruating adolescents. These results document the feasibility of implementing a health education program for adolescents on menstrual hygiene in secondary schools serving rural Bangladesh.

Keywords: School-based health education; menstrual hygiene; adolescent girls; Bangladesh.

Strengths and limitations of this study

- This is the first evaluation study of a menstrual-education program among adolescent school girls in Bangladesh.
- This study evaluated the menstrual knowledge, beliefs, and practices of students grade 6-8 in Bangladesh. We also evaluated menstrual disorders experienced by the adolescents.
- The educational program showed significant increases in knowledge (51% to 82.4%), beliefs, and practices (28.8% to 88.9%).
- Significant improvements were also observed with regards to the restrictions on visits to relatives, friends, and school attendance during menstruation.
- The same educational program should be implemented for all adolescent girls in Bangladesh.

INTRODUCTION

Adolescence is a period of rapid transition in life from girlhood to womanhood. The onset of menstruation is one of the most important changes that occur for girls during the adolescent years.[1] The first menstruation (menarche) occurs between the ages of 11 and 15. [2-3] Poor menstrual hygiene and inadequate self-care are major determinants of morbidity and other complications among this age group. Some of these include urinary tract infections, scabies in the vaginal area, abnormal abdominal pain, complications during pregnancy, and absence from schools. [4-7] In many parts of developing countries a culture of silence surrounds the topic of menstruation and related issues. [8-9] As a result, many young girls lack appropriate and sufficient information regarding menstrual hygiene. Infections due to lack of hygiene during menstruation have been reported in many studies. [10-15] They also revealed that most adolescent girls had incomplete and inaccurate information about menstrual physiology and hygiene. The menstrual information they did have was acquired primarily through mothers, television, friends, teachers, and relatives. [5, 16-17]

Menstruation is still regarded as something unclean or dirty in Bangladeshi society. [4] Because of various myths, misconceptions, and restrictions practiced during menstruation, adolescent girls in Bangladesh often develop negative attitudes towards this natural physiological phenomenon. The majority of girls lack scientific knowledge about menstruation and puberty. [18] Adolescent girls in Bangladesh are often reluctant to discuss this topic with their parents and hesitant to seek help regarding their menstrual problems. Most girls are not informed about menarche or how to manage menstrual bleeding. [18] Studies in rural Bangladesh and India found that 69.0% of adolescent girls were using old pieces of cloth or even no protection at all during menstruation. [19-20] Therefore, the need to create awareness and increase access to the requisite

sanitary infrastructure related to menstrual hygiene is important for school-aged adolescents in Bangladesh.

Learning menstrual hygiene is a vital part of health education for adolescent' girls so they can carry on regular work and habits throughout their adult life.[21] The ideal menstrual health education curriculum would encourage students to think about the relationships between knowledge, choice, behaviors, and enhanced human health. It would also help to improve maternal health which can have an impact on MDGs, for example MDG5. [22] However, despite the apparent need to achieve millennium development goals (MDGs), to our knowledge no study has been conducted on menstrual hygiene educational intervention among school girls in Bangladesh. Therefore, the present study was designed to evaluate the effectiveness of a school-based menstrual education program regarding (1) menstrual knowledge, beliefs, and practices, (2) menstrual disorders experienced, and (3) the restrictions practices by 6-8 grade school girls in Bangladesh.

METHODS

Study design and participants

This intervention study was conducted in Araihazar Thana, located at the Narayanganj District in Bangladesh. Araihazar Thana is located 25 km south-east of the capital, Dhaka. The total area of this Thana is 183.35 km² with 63,080 household units and a population of 331,556. Males constitute 51.7% of the population, and females 48.3%. Araihazar has an average literacy rate of 53.0% (7+ years of formal education), compared to the national average of 68.4%. [23]

Out of 26 high schools (grade 6-10) in the study area, 2 were full government schools and 24 were semi-government schools. From these 2 government schools, we selected one and from the 24 semi-government schools, we selected two, using a simple random sampling method (drew numbers). We only selected 3 schools due to our time limit and resources. In addition, the possible reasons for choosing these schools are that, they were well-established, older schools, and conveniently located. From these three schools, one was girls-only and the other two were co-educational. The socioeconomics, cultural norms, religions, and geographical locations of these schools were very similar to each other but not adjacent (distance between the schools was more than 2 kilometers). In those three schools, 597 school aged girls were adolescents. Out of the 597, 438 were willing to join in the study. However, 22 school aged girls had not yet reached the age of menarche. Therefore, the final participants were 416 (Figure 1). Participants were selected using the following criteria: (1) they were within grades 6-8, (2) not critically ill, and (3) had achieved menarche. Participants were aged between 11-16 years old and they were living with their parents.

Data collection procedure

Before conducting each interview, SEH, the principal investigator of this study, visited all three schools and received permission to conduct the survey and to provide health education to adolescent girls of the corresponding schools. After the permission, we conducted a pilot survey of the questionnaire and revised it, as suggested, for the final survey. Using the general guidelines, required for a full study we considered 10% of the sample (n=42) for our pilot test within one of the schools in the study area. [24] The questionnaires were drafted in English and then translated into Bangla, the national language of Bangladesh. Back-translation from Bangla

to English was done before and after the pretest questionnaires were tested, as a validation exercise. We also modified the questionnaire based on the results of the pre-test to make it more understandable and easier for participants to answer. The baseline survey was conducted in April 2012. Trained RAs read the questions out loud and the participants answered. A group of 12-15 students were involved in each survey class room lead by one RA and we requested them not to discuss the survey questions with their peers. After one session, we invited another group to participate in the survey. The room was provided by the schools.

After completion of the baseline survey, we hired one supervisor, a local Obstetrician and Gynecologist, and 3 research assistants (RAs) with good knowledge of the study's target population. Prior to the survey, we gave 4-days training to RAs and one female school teacher (selected from the corresponding schools) on adolescent health education focusing on menstrual hygiene and on the importance of maintaining the confidentiality of the participants' information. The training was done using a field manual which we developed in the Bangla language. Menstrual education focused on menstrual hygiene knowledge, beliefs, and behaviors, menstrual disorders, and restrictions on menstruating adolescents. The education materials were developed by our employed OB/GYN and ensured culturally acceptable for the girls. They received menstrual health education by the female RAs and in the same class room where they were taught regularly. Males were not allowed entry there during health education. Twelve 45-minute lessons were delivered by the RAs once every 15 days. The lessons were mostly verbal but RAs also demonstrated with clean cloths and pads, and showed how to dry and store them. Female RAs were recruited for the study, so that adolescent girls would feel comfortable discussing these issues. Furthermore, 12 Focus Group Discussions (FGDs) were conducted in the schools so that RAs and adolescent girls could become well acquainted with each other, as this is

a very sensitive topic to discuss in Bangladesh. In addition, FGDs were conducted in order to evaluate the effectiveness of the intervention using a qualitative approach. After six months of intervention, follow-up data collection was carried out in the schools using the same questionnaire as used in the baseline regarding menstrual hygiene knowledge, beliefs and practices, types of complications, and restrictions on menstruating adolescents. RAs visited the students' homes who were not available at school during the follow-up data collection. In students' homes, RAs provided the questionnaire to the students and spoke in a private room to get the answers in keeping with how the data was collected in the schools.

Including other socio-economic data, we also asked the participants about the number of persons per sleeping room in their home; type of floor in the house; type of roof; type of wall; type of cooking fuel; presence of household assets including electricity supply, radio, TV, mobile phone, refrigerator, watch, bicycle, motorcycle, source of drinking water; and, type of sanitary facility.

This study protocol was reviewed and approved by the ethical committee of Bangladesh Medical Research Council (BMRC). Prior to conducting the baseline survey, participants were informed about the study, invited to participate, and informed of their right to decline. Written consent was obtained from the parents and verbal consent was obtained from the Head teacher, class teacher, and participants. In addition, we obtained written permission for this study from the local Education Officer under the Ministry of Education (MoE) in Bangladesh.

Measures

Intervention components

Knowledge and beliefs about menstruation

This section of the questionnaire consisted of 10 multiple choice questions to determine pupils' knowledge regarding (1) normal monthly duration of menstruation, (2) poor menstrual hygiene predisposing infection, (3) hygienic practices preventing menstrual pain, (4) menstrual blood being considered impure, (5) proper sanitary products, (6) cause of menstruation, (7) origin of menstrual blood, (8) age of normal cessation of menstruation, (9) hot or cold food affecting menstrual cycle, and (10) menstruation as an assurance of fertility (fecundity).

The students' knowledge and beliefs were scored using a system adopted from previous studies. [25-27] Each correct response was awarded one point, whereas any incorrect or "don't know" answers attained no mark. This gave a total possible score of 10 points. Respondents that scored 0-3 points were adjudged as having poor knowledge, those with 4-7 points, medium knowledge, and those with 8-10 points were considered to have high knowledge. The *Cronbach* α was 0.73 for knowledge and beliefs instrument.

Practices related to menstrual hygiene

This section of the questionnaire consisted of seven items assessing girls' practices of menstrual hygiene: (1) absorbent used during menstruation, (2) frequency of changing out absorbent per day, (3) drying of used absorbent, (4) storing of washed clothes, (5) methods of displace/disposal of the used absorbent, (6) cleaning of external genitalia, and (7) material used for cleaning of external genitalia. A score of 2 was given for good hygienic practices, a score of 1 was given for fair practices, and a score of 0 was given for poor practices. The maximum score was 14 points.

Students that scored 0-4 points, 5-8 points, and 9+ points under practice were adjudged as having poor, fair, and good practices respectively. The *Cronbach* α was 0.82 for practice instrument.

Menstrual disorders experienced and restrictions during menstruation

Regarding menstrual disorders experienced by the adolescent, the following items were evaluated: (1) regularity of menstrual cycle, (2) types of complications experienced during menstruation, and (3) consultation with someone for menstrual-related complications. Moreover, this section also consisted of items to assess girls' restrictions during menstruation: (1) visits to holy places, (2) visits to relatives, friends, and neighbors, (3) participation in household activities, and (4) school attendance during menses. Dysmenorrhea was considered as pain in the abdominal, groin and lumbar regions on the day before or on the first day of menstruation. [28] We also assessed adolescent depression using the Children Depression Inventory (CDI). [29] The CDI consists of feelings and ideas grouped into 27 items. The scale scores range from 0 to 54. The *Cronbach α* was 0 .73 for this study. We followed a cut-off score ≥ 20 as depressed. [30-31]

Stress was measured using validated Perceived Stress Scale-10 (PSS). [32-33] The PSS scale scores range from 0 to 40 with a high score representing high social stress. The *Cronbach α* was 0.75. A cut-off score of greater than the median ≥ 20 was considered as high stress mood. [31]

Statistical analysis

Data were cross-checked for consistency before final data entry, using Microsoft Excel. One data entry Officer did the data entry and then cross-checked it with the Principal Investigator of the study. Descriptive analyses were conducted to estimate socio-demographic characteristics of the respondents. The household wealth index is used as a proxy indicator for household wealth

status. The wealth index was constructed from existing data on a household's ownership of 15 durable assets and housing materials reported by the participants. Each asset was assigned a weight (factor score) generated through principle components analysis, and the resulting asset scores were standardized in relation to a standard normal distribution with a mean of zero and a standard deviation of one. Each household was then assigned a score for each asset, and the scores were summed by household. The sample was then divided into population tertiles; poor, middle, and rich. We used McNemar's Chi-square analyses as because the same individuals are measured (before and after the survey) twice to evaluate the impact of an education program on four recurrent themes of menstruation: (i) knowledge and beliefs; (ii) menstrual disorders experienced; (iii) hygiene practices; and (iv) menstruation behavior and restrictions of the school-aged adolescent girls between the baseline and the follow-up period. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 18 (SPSS Inc., Chicago, IL, USA). In all analyses, the level of significance was set at $P<0.05$ (two-tailed).

RESULTS

More than half of the respondents (52.4%) were 11 to 13 years old, 13.7%, and 11.8% of the respondents reported that their parents had no education (Table 1). Approximately 95% were Muslim and 41.8% reported had a household member size of six or more. Out of 416 participants, 27.9% were defined as being poor, 34.6% belonged to middle bands of wealth, and 37.5% were defined as being rich. Regarding their house type, 17.1% reported to live in a *pacca*, 14.4% in a *half-pacca*, and 68.5% in a *kancha house* (Table 1).

In the pre-test stage, 77.4%, 68.3%, and 67.1% of girls mentioned that they had knowledge regarding the duration of a normal average menstrual cycle (between 21 to 35 days), that poor menstruation can predispose infection, and that hygienic practices during menstruation period can prevent menstrual pain. In the follow-up period, adolescents reported to have significantly increased (P<0.001) their knowledge of these three indicators (93.5%, 95.7%, and 94%). In the follow-up period, adolescents also mentioned that they improved their knowledge that menstrual blood is not impure (67.1% vs 95.9%) and that proper sanitary products should be used for menstrual protection (57.9% vs 81.5%). There was no statistically significant difference between the baseline and the follow-up period regarding respondents' correct knowledge on the cause of menstruation, origin of menstrual blood, or that menstruation was an assurance of fertility. However, during the follow-up period, significantly, adolescents reported to have increased their correct knowledge regarding age of normal cessation of menstruation and that there is no influence of hot and cold foods on menstrual cycle. Overall, significant improvement (P<0.001) was observed regarding adolescents self-reported high knowledge and beliefs scores at the follow-up period compared with the baseline (51% vs 82.4%; Table 2).

With regards to absorbent used during menstruation, more than 16% of the participants mentioned that they used sanitary pads during menstruation period at the base line and this was increasing to be more than 39% percent after the education program. Frequency of changing pads/cloths per day and drying absorbent outside the room with sunlight was higher in the follow-up period compared with the baseline. No significant differences were observed in storing of washed clothes between the baseline and the follow-up period. Methods of disposing the absorbent through burial/burning or through dustbin were significantly higher at the follow-up period compared with the baseline. Significant improvement was observed at the follow-up

period in cleaning of genitalia every time the toilet was used or during bathing. It was higher at the follow-up period than at the baseline (Table 3). In addition, no significant differences were observed in material used to clean external genitalia between the baseline and the follow-up period. Regarding hygienic practices, participants stated that they had significant improvement (88.9% vs 28.8%) in good practices during the follow-up period compared to the baseline.

At the baseline, 94.5% and 78.6% girls reported that they had regular menstrual cycles and had experienced complications during menstruation. In the follow-up period, significant improvement was seen with regard to regular menstrual cycle (99.5%; P=0.023) and lowering the complications experience during menstruation (59.6%*;* P=0.003). For the physiological symptoms, a significantly lower number of adolescents reported to experience excessive bleeding and greasy skin at the follow-up period compared with the baseline. Regarding dysmenorrheal complexity, significantly lower numbers of adolescents reported experiencing abdominal pain and nausea and or vomiting at the follow-up period. With regard to psychological symptoms, significant differences were observed in experiencing discomfort, stress, and depression between the baseline and follow-up periods. At the follow-up period, respondents mentioned that they were significantly more likely to consult someone for menstrual related complications than at the baseline (99.8% vs 90.8%; Table 4). During the baseline survey, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% of girls reported that they did not attend school during menstruation (Table 4). In the follow-up period, significant improvements were observed with regard to restrictions followed by them. No significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses.

DISCUSSION

To the best of our knowledge, this is the first study to evaluate school-based menstrual educational intervention on knowledge, beliefs, and practices of school-aged adolescent girls in Bangladesh. The present study demonstrates that the knowledge and beliefs regarding menstrual hygiene was low before the implementation of the program. After implementation of the program, there was a significant increase in knowledge among the adolescents, from 51% to 82.4%. This finding coincides with those of other studies in Saudi Arabia and Egypt which revealed the same results. [34-35]

Hygiene related practices during menstruation are of considerable importance as it affects health by increasing vulnerability to infection especially infections of the urinary tract and perineum. [4] Poor menstrual hygiene management also effects reproductive tract infection (RTI). [36] In this study, only 22.4% of girls are using pads even after the health education. The rest are using poor quality cloths. The cloths are colored using toxic elements which might make them susceptible to uterine pain. On the other hand, they dry the cloths inside the room which might have effects also. Good hygiene, such as the use of sanitary pads and adequate washing of genital area, is essential during menstruation. [4-6] Girls of reproductive age need access to clean and soft absorbent sanitary products, which in the long run protects their health. In the present study, during the pre-intervention phase, only 28.8% of adolescents had good hygiene practices. In the post-intervention phase, there was a significant improvement in good menstrual practices (60.1%). Various studies have shown that health education increases knowledge and positive attitudes towards puberty as a natural physiological phenomenon. [37]

Regarding menstrual disorders among adolescent girls, in the pre-intervention phase 10.6% and 6.7% of adolescents reported suffering from excessive bleeding and greasy skin. After

implementation of the health education program, there was a significant reduction observed regarding such disorders. Dysmenorrhoea is a very common problem among adolescent girls; it affects their quality of life. In the pre-intervention phase 61.5% and 4.6% of adolescents suffered from abdominal pain, nausea, and vomiting; this result is similar to the study done in Egypt. [35, 38] In addition to that, dysmenorrhea (pain during menses) was reported by almost all students in this study, in which 59.8% of them had severe pain followed by back ache and fatigue. This result matched with a study done among Malaysian school girls in 2009. [39] The use of oral contraceptives and hot drinking water may suppress ovulation and reduce menstrual fluid prostaglandin (PG) activity levels which are responsible for the occurrence of dysmenorrheal. Moreover, regular exercise can induce amenorrhea and it may decrease symptoms of dysmeorhhoea. [40] Regarding psychological symptoms, discomfort and stress rate also changed significantly at the follow-up period. At the follow-up period, they were more likely to consult someone about menstrual related complications than at the baseline (99.8% vs 90.8%).

This study also demonstrated that during the follow-up period the respondents were reported to have significant improvements in regular menstrual cycles. Possible reason may be due to the fact that after the health education respondents had significantly improved their knowledge, beliefs and good menstrual practices. The other studies also suggest clear links between good menstrual hygiene practices and urinary or reproductive tract infections and other illnesses such as vaginal scabies, abnormal discharge, and urinary infections. [41] These types of infections can upset the balance of hormones and cause irregular bleeding. [42] In addition, after the health education, participant's discomfort and stress rate also changed significantly. Previous studies also found that, when a woman feels stressed, her adrenal glands secrete the hormone cortisol, which may disrupt normal hormone function and cause irregular bleeding. [43]

During the pre-intervention phase, 45.4% reported that they did not visit relatives, friends, or neighbors during menstruation and 7.7% girls reported that they did not attend school during menstruation. In the follow-up, significant improvements were observed with regard to the restrictions followed by them. However, no significant differences were observed regarding restrictions on visits to holy places or doing household activities during menses. These findings therefore illustrate that, there are still greater influences of socio-cultural beliefs and taboos regarding menstruation. Different types of restrictions on menstruating women were also reported by one Indian study [5] where girls do not perform any household work during the menses.

This intervention study provides several important findings and insights for adolescent girls. However, the study had several limitations. First, findings of this study were based on self-reported outcomes and may therefore differ from actual behavior. Adolescents may have over-reported their use of good menstrual hygiene practices in order to satisfy the interviewer. However, all the participants joined the health education session regularly. Second, information about the complications was obtained from the participants, and not from medical records due to time and budget limits, therefore, bias could have occurred that may have affected the reliability of the data. However, our trained RAs received training from physicians in order to collect such information in a reliable manner. Third, although adolescent who experienced pain in the abdominal, groin and lumbar regions on the day before or on the first day of menstruation, were considered as dysmenorrhea in this study, we could assess the degree of pain by utilizing scale. In future we will certainly consider this point. Finally, this study concluded that education regarding menses has a beneficial impact for young women in improving normal menstrual cycles. However, it may be possible that, within the passage of time in this young age group

would allow more girls to achieve ovulatory and hence regular cycles/as the young adolescent girls' bodies grow and mature they will naturally achieve more regular cycles- so it may be possible that time may help do this, not the education. A control group of girls of a similar age would be helpful to answer the questionnaire.

Finally, although all possible efforts were made to standardize the educational intervention, it is possible that other environmental factors such as differences in the abilities of RAs and their ability to disseminate study messages could affect the study outcome. Despite such limitations, the results of the present study provide important findings for policy makers to make rational decisions on improving adolescent reproductive health in Bangladesh.

CONCLUSIONS AND RECOMMNEDATION

These results document the feasibility of implementing a health education program on menstrual hygiene in secondary schools serving rural Bangladesh. The program produced significant positive changes in knowledge, beliefs, practices towards menstrual hygiene, disorder experiences, and restrictions on menstruating adolescents. More intense or longer interventions may be needed to significantly improve good menstrual hygiene practices in this population. Taking into account the health implications and prevailing socio-cultural and economic factors, there is also an urgent need for intensifying effective strategies to persuade the adolescent school girls to adopt healthy menstrual practices. A well-informed continuous, school education program should be imparted to the students. In addition, the findings emphasize the inclusion of safe hygiene and sanitary practices that should be included in the school curricula as well as greater communication between female students and teachers and between daughters and mothers.

Acknowledgments This research was supported by 'Honjo International Scholarship Foundation', Japan. The authors would like to thank them for their financial contribution to this important study. We also wish to thank all participants, teachers, and education officers who aided in conducting this research. Finally, we must thank Dr. Nowsheen Sharmin Purabi, Register Gyn. and Obst. at Anwer Khan Medical College, Dhaka, Bangladesh for her training and support for the Research Assistants which made it possible to conduct this research.

Contributors EHS and KS develop the proposal and implement the study. KI and MM was involved in the field study. MR and EHS did the analyses and wrote the manuscript. All authors checked and approved the final manuscript.

Funding This study was funded by "Honjo International Scholarship Foundation', Japan.

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

REFERENCES

1. World Health Organization. Adolescent friendly health services. An agenda for change. *World Health Organization*. Geneva: 2002.

2. Marianne E, McPherson E, Korfine L. Menstruation across time: menarche, menstrual attitudes, experiences and behaviors. *Women's Health Issues* 2004; 14: 193-200.

3. Aniebue UU, Aniebue PN, Nwankwo TO. The impact of pre-menarcheal training on menstrual practices and hygiene of Nigerian school girls. *Pan Afr Med J* 2009; 2:9.

4. Rokeya A, Kabita Y. Menstrual hygiene: breaking the silence. *Water Aid Bangladesh* 2007; 283-87.

5. Dasgupta A, Sarkar M. Menstrual hygiene: How Hygienic is the Adolescent Girl? *Indian J Comm Med* 2008; 33:77-80.

6. Menstrual Hygiene. Feminine Hygiene, Gynaecology and Menstruation Information, Resources and Pro-sducts for Dads and Husband. http://www.mens-trualhygiene.com

7. Ayalew T, Meseret Y, Yeshigeta G. Reproductive Health Knowledge and Attitude among Adolescents: A community based study in Jimma Town, Southwest Ethiopia. *Ethiop J Health Dev* 2008; 22: 243-251.

8. Suneela G, Nandini S, Ragini S. Socio-cultural Aspects of Menstruation in an Urban Slum in Delhi, India. *Reprod Health Matters* 2001; 9: 16-25.

9. Olayinka OO, Akinyinka OO. Unmet Need for Sexuality Education among Adolescent Girls in Southwest Nigeria: A Qualitative Analysis. *Afr J Reprod Health* 2004; 8: 27-37.

10. Ahuja A, Tiwari S. Awareness about pubertal changes among adolescent girls. *Journal of Family Welfare* 1995; 41: 46-50.

11. Chaudhari RH. Socio-economic demographic and reproductive health profile of adolescents in the SAARC countries. Paper presented in south Asia Conference on Adolescents; 21-23 July 1998; New Delhi, India.

12. Khanna A, Goyal RS, Bhawsar R. Menstrual practices and reproductive problems: A study of adolescent girls in Rajasthan. *Journal of Health Management* 2005; 7: 91-97.

13. Mudey AB, Keshwani N, Mudey GA, et al. A cross-sectional study on the awareness regarding safe and hygienic practices amongst school going adolescent girls in the rural areas of Wardha district. *Global Journal of Health Science* 2010; 2: 225-231.

14. Bhatia JC, Cleland J. Self-reported symptoms of gynecological morbidity and their treatment in south India. *Studies in Family Planning*1995; 26: 491-495.

15. Mehara S. (Ed), Adolescent Girl: An Indian perspective. MAMTA Health Institute for Mother and Child, Saket, New Delhi. 1995: pp. 75-78.

16. Ghattargi CH, Deo DS. Preparation and Practices regarding Menstruation: A comparative study in Rural and Urban Adolescent Girls. *Indian J of Comm Med* 2005; 30: 10-14.

17. Singh AJ. The place of menstruation in the reproductive lives of women of rural north India. *Indian J of Comm Med* 2006; 31:10-14.

18. Kabir B, Barua MK, Ahmed M. Improving menstrual hygiene facilities in secondary schools Initiatives from BRAC-WASH Program. Dhaka, Bangladesh, 31 January -2 February 2012.

19. Ali A, Mahmud SN, Karim A, et al. Knowledge and practice of NFPE-AGG graduates regarding menstruation. Dhaka: Bangladesh Rural Advancement Committee, 1996.

20. Drakshayani Devi K, Venkata Ramaiah P. A study on menstrual hygiene among rural adolescent girls. Indian *J Med Sci* 1994; 48: 139-143.

21. Narayan KA, Srinivasa DK, Pelto PJ, et al. Puberty rituals, reproductive knowledge and health of adolescent school girls in South India. *AP Pop Jour* 2001; 16: 225-238.

22. Ten VTA. Menstrual Hygiene: A Neglected Condition for the Achievement of Several Millennium Development Goals. Zoetermeer: Europe External Policy Advisors (EEPA), 2007. http://www.wsscc.org/resources/resource-publications/menstrual-hygiene-neglected-condition-achievement-several-mdgs accessed on 30 May 2014.

23. Bangladesh Bureau of Statistics (BBS), 2007. *BBS Report* 2007. Government of the People's Republic of Bangladesh. http://www.bbs.gov.bd/Home.aspx accessed on 12 June 2013.

24. Hertzog MA. Considerations in determining sample size for pilot studies. *Res Nurs Health* 2008; 31(2):180-191.

25. Lawan UM, Yusuf NW, Musa AB. Menstruation and Menstrual Hygiene amongst Adolescent School Girls in Kano, Northwestern Nigeria. *Afr J of Reprod Health* 2010; 14: 201-207.

26. Anju A, Patil R. Menstrual Hygiene and Practices of Rural Adolescent Girls of Raichur. *Int J Biol Med Res* 2013; 4: 3014- 3017.

27. El-Gilany AH, Badawi K, El-Fedawy S. Menstrual Hygiene among Adolescent School girls in Mansoura, Egypt. *Reprod Health Matters* 2005; 13:147–152.

28. Liu H, Yang F, Li Z, et al. Passive smoking, Cyp1A1 gene polymorphism and dysmenorrhea. *Reprodu Toxicol* 2007; 24: 114-119. DOI: 10.1016/j.reprotox.2007.04.069.

29. Kovacs M. The children's depression inventory. *Psychopharmacology Bulletin* 1985; 21: 995-998.

30. Kovacs M. Children's Depression Inventory. North Tonawanda, NY: Multi-Health Systems, Inc. 1992.

31. Yaacob SN, Mansor RJ, Ikechukwu AT. Loneliness, stress, self-esteem and depression among Malaysian adolescents. *Jurnal Kemanusiaan Bil*.14, Dis 2009.

32. Cohen S, Karmarck T, Mermelstein R. A global measure of perceived stress. J *Health and Social Behavior* 1983: 24: 385-396.

33. Chakraborti A1, Ray P, Sanyal D, et al. Assessing perceived stress in medical personnel: in search of an appropriate scale for the Bengali population. *Indian J Psychol Med* 2013; 35(1):29-

34. Ayafi SA. Factors associated with health behavior regarding menstruation among Saudi intermediate school girls in Riyadh city. Master thesis, Nursing College, King Saud University 1999.

35. Hassanen H, Tosson M, El-Elkareem EA. Effect of health education and training program for secondary school students on menstruation at Assiut Governorate. *Bulletin of High Institute of Public Health* 2004; 34: 575-94.

36. Sumpter C, Torondel B. A Systematic Review of the Health and Social Effects of Menstrual Hygiene Management. *PLoS ONE* 2013; 8(4): e62004. doi:10.1371/journal.pone.0062004.

37. Afzali M, Allameh R. Study of educational needs of 12-14 years old girls about adolescent health and determines appropriate and effective strategies for adolescent health education. *Koomesh* 2000; 1:39-47.

38. Eswi A, Helal H, Elarousy W. Menstrual attitude and knowledge among Egyptian female adolescents. *J of Am Sci* 2012; 8: 555-565.

39. Lee K, Chen Y, Lee K, et al. Menstruation among adolescent girls in Malaysia: a cross-sectional school survey. *Singapore Medical Journal* 2006; 47: 869-874.

40. Warren MP, Rebecca JL. What is the effect of exercise on primary dysmenorrheal? Products and prostaglandins as a root of menstruation WJSM, 1999; 33: 227.

41. Water Aid, Nepal. Menustraul hygiene in South Asia: a neglected issue for WASH (Water, sanitation, and hygiene) programs. WaterAid, Pokhara, Nepal, 2008. Available at: http://www.wateraid.org/~/media/Publications/menstrual-hygiene-south-asia.pdf accessed on 25 May 2014.

42. Hormone fact sheet. Health and Wellness Institute, Mountlake Terrace, Wa 98043; 2013. Available at http://hwifc.com/wpcontent/uploads/2013/02/Hormone_Fact_Sheet.pdf accessed on 25 May 2014.

43. Markovic N, Markovic O. What Every Woman Should Know about Cervical Cancer. 2008 Springer publication, 2008.

Table 1: Socio-demographic characteristics of the participants (n=416)

Characteristic	Number (n)	Percentage (%)
Age, years		
11-12	64	15.4
13	154	37.0
14+	198	47.6
Religion		
Muslim	394	94.7
Non-Muslim	22	5.3
Father's education		
No education	57	13.7
Incomplete primary	176	42.3
Complete primary	94	22.6
Secondary or higher	89	21.4
Mother's education		
No education	49	11.8
Incomplete primary	173	41.6
Complete primary	119	28.6
Secondary or higher	75	18.0
Household size		
2-4	116	27.9
5	126	30.3
6+	174	41.8
House type		
Pacca	71	17.1
Half-pacca	60	14.4
Kancha	285	68.5
Wealth Index[a]		
Poor	116	27.9
Middle	144	34.6
Rich	156	37.5

[a]Constructed from data on household assets, including ownership of durable goods (such as televisions and bicycles) and dwelling characteristics (such as source of drinking water, sanitation facilities, and construction. We used principal components analyses to assign individual household wealth scores.

Pacca means brick-built; *Half-pacca* means only floor is brick-built and no brick in the roof; *Kancha* means no brick in the house.

Table 2: Impact of menstrual educational program on correct menstruation knowledge and beliefs (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Duration of normal menstruation cycle	322	77.4	389	93.5	16.1	**0.002**
Poor menstruation hygiene predispose to infection	284	68.3	398	95.7	27.4	**<0.001**
Hygiene can prevent menstrual pain	279	67.1	391	94.0	26.9	**<0.001**
Menstruation blood is impure	279	67.1	399	95.9	28.8	**<0.001**
Proper sanitary products should use for menstruation protection	241	57.9	339	81.5	23.6	**<0.001**
Cause of menstruation	334	80.3	353	84.8	4.5	0.886
Origin of menstruation blood	41	9.9	55	13.2	3.3	0.687
Age of normal cessation of menstruation	245	58.9	352	84.6	25.7	**<0.001**
Influence of hot or cold food on menses	273	65.6	358	86.1	20.5	**0.001**
As an assured fertility (fecundity)	179	43.0	190	45.7	2.7	0.556
Knowledge and beliefs grading						
Poor (0-3)	120	28.8	7	1.7	-27.1	**<0.001**
Medium (4-7)	84	20.2	66	15.9	-4.3	
High (8-10)	212	51.0	343	82.4	31.4	

We categorized as poor knowledge (0-3 pints), medium (4-7 points), and high (8-10).

Table 3: Impact of menstrual educational program on menstrual hygienic practices by adolescent girls (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Absorbent used during menstruation						
Sanitary pad	70	16.8	163	39.2	22.4	**0.003**
New cloths	207	49.8	209	50.2	0.4	
Old cloths/others	139	33.4	44	10.6	-22.8	
Frequency of changing pad/cloths per day						
4+ times	35	8.4	321	77.2	68.8	**<0.001**
2-3 times	322	77.4	93	22.4	-55.0	
1 time	59	14.2	2	0.5	-13.7	
Drying of used absorbent						
Outside room with sunlight	78	18.8	401	96.4	77.6	**<0.001**
Inside room with sunlight	46	11.1	5	1.2	-9.9	
Inside/outside room without sunlight	292	70.1	10	2.4	-67.7	
Storing of washed clothes						
Clean and covered place[a]	159	38.2	170	40.8	2.6	0.077
Clean and open space[b]	104	25.0	85	20.4	-4.6	
Unclean and open/covered place[c]	153	36.8	129	31.0	-5.8	
Methods of displace/dispose						
Buried/burn/dustbin	235	56.5	341	82.0	25.5	**0.004**
Latrine	65	15.6	49	11.8	-3.8	
Throw on the roads	116	27.9	26	6.2	-21.7	
Cleaning of genitalia						
Every time during toilet use	65	15.6	145	34.8	19.2	**0.005**
During bathing	202	48.6	254	61.1	12.5	
Do not clean	149	35.8	17	4.1	-31.7	
Material used for cleaning of External genitalia						
Water and antiseptic	30	7.2	45	10.8	3.6	0.448
Soap and Water	199	47.8	191	45.9	-1.9	
Only water/not cleaning	187	45.0	180	43.2	-1.8	
Practice grading						
Poor (0-4)	60	14.4	3	0.7	-13.7	**0.012**
Fair (5-8)	236	56.8	43	10.3	-46.5	
Good (9+)	120	28.8	370	88.9	60.1	

[a]Suitcase, box, cupboard, and shopper; [b]Store room, anywhere in the room, under cushion, under the bed, behind the door, within the washroom; [c]Gallery, under the kitchen roof, anywhere in the room, under cushion, under the bed, behind the door, within the washroom.

Table 4: Impact of menstrual educational program on menstrual disordered experienced, behaviors and restrictions (n=416)

Characteristics	Baseline		Follow-up		Percentage Change	*P*-value
	N	%	N	%	%	
Menstrual disorders experienced						
Regularity of menstruation	393	94.5	414	99.5	5.0	**0.023**
Complications during menstruation	327	78.6	248	59.6	-19.0	**0.002**
Types of complications during menstruation						
Physiological symptoms						
Excessive bleeding	44	10.6	13	3.1	-7.5	**<0.001**
Headache	32	7.7	28	6.7	-1.0	0.789
Increase appetite	26	6.2	18	4.3	-1.9	0.297
Greasy skin	28	6.7	6	1.4	-5.3	**0.002**
Dysmenorrhea						
Pain in abdominal/groin/ lumber region	256	61.5	219	52.6	-8.9	**0.012**
Psychological symptoms	35	8.4	13	3.1	-5.3	**0.025**
Discomfort	22	5.3	3	0.7	-4.6	**0.032**
High stress©	16	3.8	6	1.4	-2.4	0.052
Irritability	18	4.3	3	0.7	-3.6	**0.044**
Depression*						
Consult with someone for menstruation related complications	378	90.8	415	99.8	9.0	**0.003**
Behaviors and restrictions						
Visit relatives, friends, and neighbors during menses						
No	189	45.4	110	26.4	-19.0	**0.002**
Yes	227	54.6	306	73.6	19.0	
Doing household activities during menses						
No	94	22.6	85	20.4	-2.2	0.438
Yes	322	77.4	331	79.6	2.2	
Attending school						
No	32	7.7	11	2.6	-5.1	**0.019**
Yes	384	92.3	405	97.4	5.1	

*A cut-off score ≥ 20 as depressed. ©A cut-off score of greater than median ≥ 20 was consider as high stress mood.

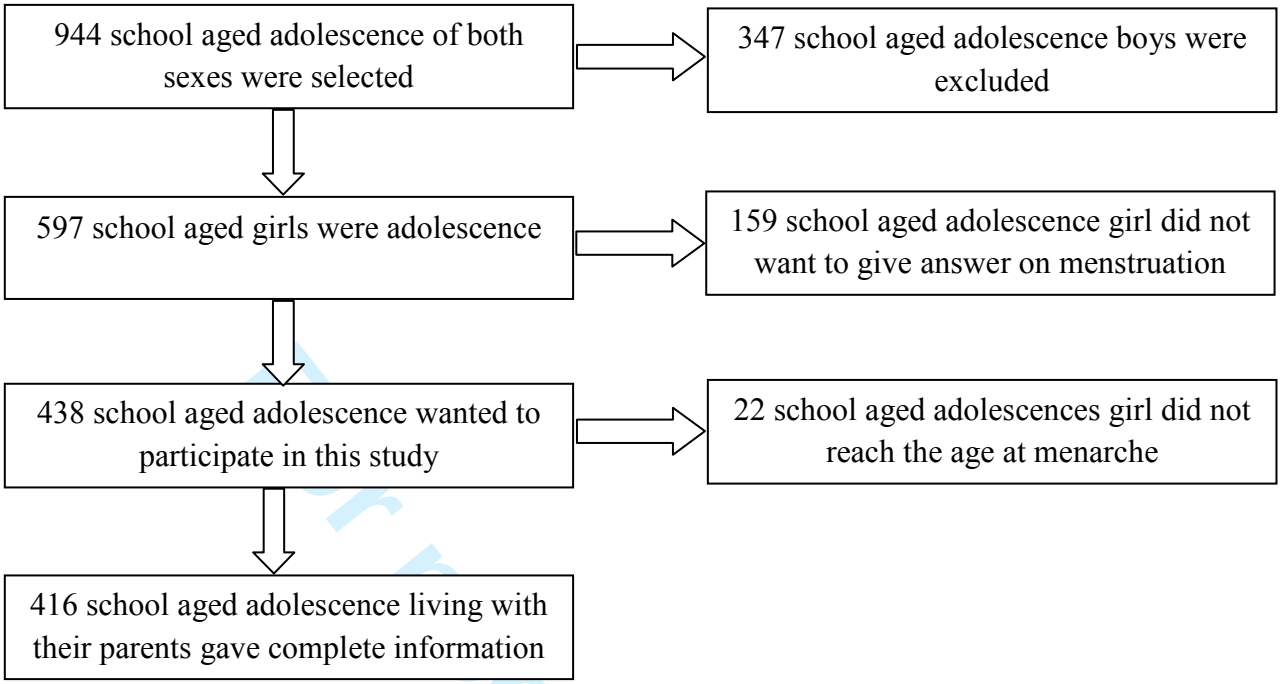


Figure 1: Selection of sample.

90x51mm (300 x 300 DPI)